NUARY, 1942

DEC 19 194

TESTING NUMBER

Industrial Arts and VOCATIONAL EDUCATION

PERIODICAL ROOM
GENERAL LIBRARY

★ Interrelationships of Industrial Arts and Vocational Education

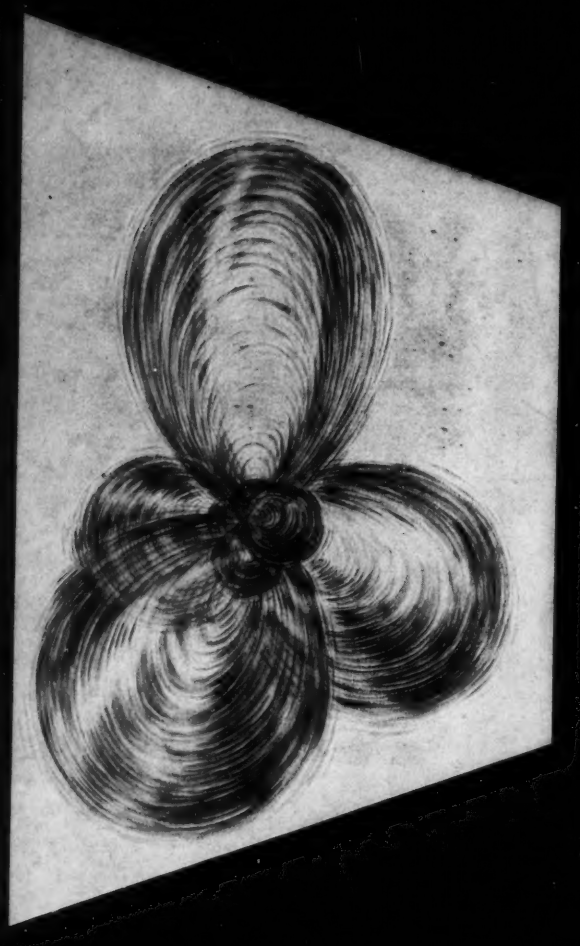
★ Objectives of Industrial Education

★ Spatial Perception Tests for Determining Drafting Aptitude

★ Methods of Testing in Mechanical Drawing

★ A Performance Test Involving Accuracy, Finish, and Time

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE



IN THE CELLAR,
IT'S WORTH 12 DOLLARS A T(
IN THE SHOWCASE, IT'S WOR1
2
BILLION

Your Requirements vs. NATIONAL SECURITY

The demand for Dietzgen Drawing Instruments today greatly exceeds the present available supply. First, the national defense requirements are making a tremendous demand on our production capacity. Second, the critical materials used in making Dietzgen quality instruments impose a drastic limitation on production for other than defense needs. Your tolerant understanding of this situation is appreciated.

DIETZGEN

EVERYTHING FOR

DRAFTING AND SURVEYING

It is one of nature's strange contradictions that a diamond and a lump of coal are "brothers under the skin." Both are carbon; both derive from ancient vegetation. Yet wars have been waged to win diamond deposits, and a single flawless gem may bring thousands of dollars in the open market. As for a lump of coal . . . it is something for a mischievous boy to peg at a cat.

Why this tremendous difference in values?—Simply the influences brought to bear on the original carbon deposits during what may be called their "formative years." The story of the Diamond and the Lump of Coal is another of the endless list of examples demonstrating what every intelligent educator knows . . . how early influences play a dominating role in shaping the careers of men-to-be. Wise educators know how plastic the young mind and spirit are. They know there's not a great deal of difference between the talent possessed by one boy and the ability possessed by another. They know that the will to win resides in the heart of every mother's son. They know that the influences brought to bear on a youngster will make the *great* difference between failure and achievement.

That is why educators who are truly worthy of the name go beyond the routine of "instruction" and seek to surround their students with the influences that fan into flame the spark of achievement. That is why exceptional instructors in mechanical drawing urge the use of fine quality drawing instruments. For, *chosen with care,* these instruments in the act of truly creative work can open up a new realm in the imagination of a youngster. They set a goal, and they show the way in which it is achieved. They initiate a boy into the discipline which is so essential a part of achievement. They train him in sensitive craftsmanship, in higher ideals and aims. They can even stimulate his ambition and lift his ability. Their slightly higher cost, when compared with their value and their use, is as nothing in this important work, the making of a man.

EUGENE DIETZGEN CO.

Chicago • New York
Pittsburgh • San Francisco • Milwaukee • Los Angeles
Philadelphia • Washington • New Orleans
Dealers in All Principal Cities

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

VOL. 31 JANUARY, 1942 Number 1

General
Wahr

SEASON'S GREETINGS

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION wishes all of its readers A Merry Christmas and A Happy New Year.

This Issue

This month's issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is especially devoted to tests and testing. Several of the 12 testing articles really partake of the nature of research studies.

All of these tests have been prepared by instructors who found use for them in their classes. Several of them are designed for the drafting room, several more for the woodworking shop, one is a pretest for the industrial-arts laboratory, another was constructed for the print shop, and there are several for the metalworking shop.

Every one of these tests has been found helpful. Every one of them contains some items that might be found useful in other classes. Some are so well constructed that many teachers may want to adopt them just as they are.

Whether they suit every one of our readers is not the question, however. If they do nothing more than call attention to the need for testing, now that the end of the first semester is approaching, they will have served their purpose.

Those teachers who feel that the tests included this month do not suit their particular needs, should scan them for such items as they may want, and then refer to the many other tests published in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION during the past years for additional useful testing material.

CONTENTS

Interrelationships of Industrial Arts and Vocational Education, *Lawrence F. Ashley*.. 1
Objectives of Industrial Education, *A. F. Dodge*.... 5
Behind and Before, *Dean M. Schweickhard*.... 8
Editorials 9

Testing and Tests

Spatial Perception Tests for Determining Drafting Aptitude, *John Edmund Crawford*.. 10
Methods of Testing in Mechanical Drawing, *Stanley S. Radford*.... 12
A Performance Test Involving Accuracy, Finish, and Time, *Robert S. Hunter*.... 13
Test for Students of Printing, *R. Randolph Karch*.... 14
Pretest for Industrial-Arts Laboratory Classes, *Raymond J. Coltharp*.... 15
Tool Test — General Metalwork, *G. L. Simnicht*.... 17
Mechanical-Drawing Test, *W. G. Hjerstedt*.... 18
Woodworking Test — Completion Questions, *Fred W. Weyer*.... 18
Tool Test — Woodworking, *G. L. Simnicht*.... 19
Woodworking Test, *Louis Barocci*.... 19
Final Mechanical-Drawing Test, *W. H. Bowers*.... 20
Metalcraft Test, *Harold L. Stiles*.... 21

Problems and Projects

A Blueprint-Paper Dispenser, *R. C. Roe*.... 22
Three Metal Ash Trays, *E. L. Longley*.... 22
Jig-Saw Details, *Frank E. Anthony*.... 24
The Size of Drawing Models, *W. W. Sturtevant*.... 28
Sandpaper Cutter and Dispenser, *Russell J. Hunt*.... 28
Wood Carving, *Hester Newey*.... 29
Radio Stool, *Earl W. Boyer*.... 31
History of the Auger Bit, *Carl v. Lindeman*.... 31
Portable Risers, *J. H. McCloskey*.... 32
A Modernistic Two-Tone Lamp, *Harold M. Gray*.... 33
Farm Scoop, *Robert H. Smith*.... 33
Motors for Small-Power Applications, *C. S. Siskind*.... 34
Pencil Holder, *Paul Cressman, Jr.*.... 35
A Child's Stool, *Hazel F. Showalter*.... 36
Inner-Tube Towel Holder, *Robert Owen*.... 37
Plan of Procedure, *Maurice J. Nelson*.... 37
Whittling-Jackknife Technique, *W. Ben. Hunt*.... 38
Kinks for the General Shop Teacher, *A. R. Warstler*.... 39
An Isometric Triangle, *Kenneth Grinager*.... 39
A Tribute to Professor Selvidge, *William T. Bawden*.... 40

Personal News 40
Questions and Answers.... 14A
Association News 14A
News Notes.... 17A
New Publications 17A
Shop Equipment News.... 20A

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

Entered January 2, 1914, as Second-Class Mail Matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright 1941, by The Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, November 25, 1930. Published monthly except during July and August.

Subscription Information. — Subscription price, $2.50 per year, payable in advance. Canadian postage, 50 cents; Foreign Countries, 50 cents. Copies not over three months old, 35 cents; more than three months, 50 cents. Notice for discontinuance of subscriptions must reach Publication Office in Milwaukee at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

PUBLISHED MONTHLY, EXCEPT DURING JULY AND AUGUST, BY THE BRUCE PUBLISHING COMPANY, 540 NORTH MILWAUKEE STREET, MILWAUKEE, WISCONSIN

Eastern Office: 330 W. 42nd St., New York, N. Y. — Western Office: 66 E. South Water St., Chicago, Ill.
Pacific Office: 1233 S. Hope St., Los Angeles, Calif.

SAFE • HEAVY • STRONG

J-50 SHAPER

Day and night . . . night and day . . . Yates-American machines can stand the pace. Increased use due to extended vocational training programs will not tax the capacity and stamina of this equipment. Overtime hours are no hardship because these are industrial-type machines built to endure hard usage . . . they are extra heavy and rigid . . . they are long-lived and cost little to maintain.

The J-50 Shaper, illustrated, demonstrates the durability we speak of. In school shops the country over, this shaper is doing more than its regular quota of work, and doing it without breakdown or interuption. The base is extra heavy to provide a solid foundation for the high speed operating parts. The strong spindle unit is mounted on gibbed ways which are adjustable for wear. Made of heat-treated alloy steel, the spindle itself runs in precision-type ball bearings, lubricated by a mist of filtered oil.

Powered by a two horsepower motor, the J-50 Shaper provides a spindle speed of 8500 R.P.M. (10,000 R.P.M. if desired at no extra cost). Drive is by means of an endless fabric belt. Easy to adjust and operate, the J-50 greatly simplifies the production of moulding and other work involving irregular contours. It will take a considerable load without chattering, raising the grain or slowing down. Let us send complete information.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

Short Talks on Wood

LONGLEAF PINE (*Pinus palustris*)

An excellent general utility wood. Also called Georgia Pine and Pitch Pine. One of a group of closely related species which are collectively known as Southern Yellow Pine. The wood is heavy, hard, strong and moderately durable. Somewhat difficult to work. Color varies from pale ochre to brownish orange.

Is highly desired as a structural timber for bridges, trestles, masts and spars. Wood of lower density is used for interior finish and light buildings. Also furnishes the bulk of the world's supply of naval stores — tar, pitch, rosin and turpentine.

Grows along the Atlantic coast from southern Virginia to central Florida, and far inland in the Gulf States. Rapid growing. Has been logged, and bled for turpentine extensively.

In its youth and middle age its handsome appearance attracts immediate attention. Mature trees are usually 50-100 feet tall with a slightly tapering trunk, about 1-3 feet in diameter, and have an open, irregular crown.

The bark is smooth, thin, with red-brown plates. The beautiful, gleaming needles grow in clusters of three, are 10-15 inches long and are gathered toward the ends of the thick, scaly twigs.

The cones are 6-10 inches long, slightly curved, and are armed with small, curved prickles. The cones usually fall soon after the seed ripens. This tree is considered to have the longest needles and largest cones of any eastern tree.

To date, thirty-one brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

Interrelationships of Industrial Arts and Vocational Education

LAWRENCE F. ASHLEY*

Logical discussions of relationships must spring from ancestry, whether of persons, or things, or processes; for ancestry deals with needs, purposes, settings, origins, beginnings, procedures and outcomes, the criteria by which the undertakings of schools are properly weighed.

Origins and beginnings are subjects for historical research, and a review of them will be of little value to groups concerned with immediate functions. The student of history will find in some centuries of evolution the seeds of present programs arising from the same philosophical soil and thriving on the same nutriment. The other criteria have to do equally with the present and the past and shall be our major concern. Ancestry needs to be examined only to the extent that present settings require for understanding the immediate, and for predicting the tomorrow. But why philosophize about tomorrow?

Some of you read the little book, *The Wave of the Future*, and were persuaded that certain forces are at work which though differing from the indoctrinations of your youth even to the extent of barbarism, may as well be accepted as the inevitable. You were forced to ask, "Is there a wave of the future," and to answer, "No, there can be no such concept." Future, even though planned remains a matter for the gods. Everything is *now* or in retrospect. We are only fairly certain of a tomorrow because we had a yesterday in which there was a reflection of today.

Recently an eminent schoolman told of the boyhood experience two miles west of the shore of Lake Winnebago, where looking west toward the prairie he saw nothing but the water which was at his back. Here was apparently a real lake, but its existence depended upon certain real situations, a real lake, some sunshine and a certain atmospheric condition. The mind of man is filled with mirages which likewise rest upon real situations though some of them may be very remote and in the form of unworked processes and materials. He is ever tying these visions to reality and excels nature by capitalizing on her processes of evolution and speeds them up so that with his own hands he has shaped a world of his own.

He is never satisfied with his creation and continues to reshape the material comforts he has made, and to create new ones with which to construct. As an individual his very existence has come to depend on his ability to do, and it is now of national significance as well as individual concern that his children approach maturity with the ability to participate in the production of the nation's goods or in the administration and organization of its business.

Requirements of Citizenship

Effective citizenship demands this participation not only for economic security but that a proper perspective or point of view may be had relative to one's duties or functions and that he may understand the point of view of others. Vocational education has attempted to take on the requirements of participation while industrial-arts objectives have leaned primarily toward the interpretations goal.

But the social order which man has set up is one of change. Varying demands bring varying requirements, and methods are ever streamlined for the necessities or vagaries of current use. If one remains in the production line he must do well what fashion decrees for the day and at the same time be alert to what may be in vogue tomorrow that he may be ready for continued usefulness, for the assurance of employment looms high as the thing of *first importance*. We find ourselves, therefore, committed to considerable elaboration of the "purposes" and "outcomes" criteria in order to understand immediate relationships and responsibilities.

One reads in the preface of *Education for Work*[1] the quotation from the Lynds in *Middletown in Transition:* "One's job is the watershed down which the rest of one's life tends to flow." While there are plenty of implications in it for all agencies of the schools, let us look at the educator's role. Obviously he cannot undertake to build watersheds for others without assuming total responsibility for their attitudes, actions, and outcomes of living, nor can he even assume the sphere of architect without incurring similar liabilities. These things may be done in a totalitarian country where the individual's initiative must be shaped continually for the benefit of the state alone. Here the educator's responsibility may be conceived as helping youth to understand the materials and processes which might be used for building their watersheds and how these structures may be bettered for both the individual and the state.

This is seen in the aims of education whenever the sponsors of public school programs have aired their objectives, and one sees general agreement on the "life preparation" formula, but unfortunately, interpretations of life have been divided between the view that it is polite society, and that it is earning one's living, with little or no effort to harmonize the two. This confusion of views has occasioned the ever present dilemma of public school education, for these interpretations have been shared by educators and laymen alike for many years. As for the view that life is polite society, we all recognize there are many things we prize and covet which, though unattainable for us as individuals,

*Chief of the Division of Vocational Education, Yonkers, N. Y. Address given at meeting of Eastern States Professional Association, Hotel Commodore, New York City, Apr. 5, 1941.

[1]Norton, Thomas L., *Education for Work*. The McGraw-Hill Book Co., New York, 1939.

we still want to insure to future generations. The heritages in art, literature, science, music, even the traditional polish of kings, hold real and personal satisfactions for us. In fact, we feel so strongly about them we are wont to overlook important foundations upon which they must rest.

Learning to Earn

The view that the first objective of schooling should be to prepare one to earn a living might be eliminated and the dilemma removed if one could be amply pensioned for his needs in food, clothing, shelter and leisure time. He could then devote himself to the purely cultural and to attainment in the realm of things mental and spiritual. Since this is not the case, to what extent must the educator be concerned with preparing pupils to earn a living? The answer cannot be given glibly, for one's own situation, and his proneness to rationalize, interfere with objective treatment. We must examine well the background of the children, their interests and needs together with the nature of our industrial order, and the offerings of the schools before we attempt a reply. What kind of people are we?

James Trueslow Adams[3] says: "We are a nation not a race. We have millions of Negroes; we have millions with German, Italian, Polish, Russian, and Scandinavian blood; and we have large blocks of citizens who came from Czechoslovakia, Mexico, Austria, Hungary and many other countries. Our minority groups number some 40,000,000 out of a total of 130,000,000; 14,000,000 of these minorities are foreign born and the remainder are children of foreign born or mixed parentage. Of our potential voting population of about 80,000,000 (of whom some 49,000,000 voted in the last Presidential election) roughly 8,000,000 were born outside the United States. Yet except for a comparatively small minority of still unnaturalized foreigners, these people are all Americans."

Though Americans, we are made up of peoples with the maximum spread of backgrounds, beliefs, attainments, and experiences imaginable. Most are poor, financially speaking. The foreign born came here to escape oppression in the mother country or to take advantage of greater individual opportunities for earning a living. They have been compelled to attend our schools and to strive to be good citizens. We have paid little or no attention to the manner in which they obtained subsistence either in school or out except in metropolitan areas, where distress became acute and certain philanthropies were induced to act.

School situations as reported in the monumental survey for the state of New York, known as the Regent's Inquiry, show vast numbers leave school as soon as the law will permit, and the typical school leaving grade to be 10.3 in small towns and villages, and 11.6 in metropolitan centers.[3] Nineteen per cent of the graduates of the general high schools said their major problem was to get a job, and 8 per cent of the graduates of the vocational high schools were likewise confronted. There was little or no vocational training available to students outside the large cities and it was remarked the only chance some youth have to get any specific skills training is to be committed to a reformatory.

Marshall,[4] in the Regent's Inquiry states: "Among the general high school pupils only one problem seemed to have much importance. This was the problem of getting and holding a job together with the planning of vocational futures."

We are told[5] that whereas at one time the secondary schools of New York were chiefly college preparatory institutions, twice as many people are in attendance now as ten years ago, and that less than 40 per cent of those entering the ninth grade remain to graduate. In other words, the high school has become the terminal institution for the training of the vast majority of pupils.

What becomes of the boys and girls who drop out before graduation? There was made public on December 24 the results of a year's study under a $25,000 grant from the General Education Board by the National Association of Secondary School Principals. The topic was "Educational Adjustment of Former High School Pupils," and covered six school systems in the east.

It was found that many of those who were out of school from one to five years were employed as sales clerks, semiskilled operatives in manufacturing, bus, taxi, and truck drivers, attendants at filling stations and parking lots, shipping and receiving clerks, and general office clerks. Girls worked as textile operatives, at jewelry manufacturing, bookkeepers, clerks and maids, with the numbers predominating in the order mentioned. Twenty-nine per cent of the unemployed youth felt that they lacked sufficient vocational skills to procure and hold a job; at the same time 20 per cent of the employed group felt that the schools could have given them more training in the development of vocational skills.[6]

John Bryan, State Administrator of the NYA for Alabama, makes more vivid another situation relative to youth with which the layman and educator have been none too familiar.[7] "In the last six years," he says, "six and a half million youth have been put to work by the Federal Government!" "The CCC has given employment to 2,300,000, the NYA has given employment to 2,400,000 and the WPA has given employment to 800,000 young people under twenty-five years of age, while various other agencies furnished employment to another million youth." Since these figures apply to youth between the ages of 18 and 25, it would be safe to say that many millions more of out-of-school youth under the age of 18 are unemployed.

Education and Crime

Coupled with the unemployment situation is the attendant crime wave which the work activities of the above-mentioned organizations have tended to alleviate. The prison population of the United States according to estimates made public December 24[8] by the Bureau of Census, consists of about 66,000 persons, of whom 94.0 per cent are men. The estimates were based on data received from 108 prisons and reformatories in forty-six states and eighteen federal institutions. The median age of all felony prisoners is 27.6 years, with that of the women averaging 29.2 years. An analysis along racial lines showed 68.8 per cent are native born whites, 26.3 per cent are negroes, 3.8 per cent are foreign born whites, and 1.1 per cent are classified as of "other races." It is interesting to note that 56.8 per cent of all crimes of males were charged against property which is indicative of poverty and a tremendous need such that reputation and often life have been risked in order to possess what lack of preparation and ability has made unattainable.

That the ability to earn tends to lessen crime is brought out by Shuder,[9] Director of San Quentin Prison, Calif., in a recent statement to the press. He said, "A definite vocational objective, with training and equipment sufficient to accomplish the desired goal, is the fundamental key to the successful future of persons committed to penal institutions. This is the conclusion I have reached after ten and one half years in this city of 5000 men. . . . Much has been said in the name of psychology, and psychiatry on the development of 'insight,' but this point of view, in spite of the clamor for it, is not as helpful as has been estimated. I reiterate, that vocational training is the key to rehabilitation." Such statements would indicate that in spite of the seeming scarcity of jobs, those who knew how to do something were less likely to end up in prison. Supporting this further is the fact that young people with initiative who have used work experiences acquired at home and at school to carve their way have made moderate successes in the worst depression years.

While prison populations emphasize the need for vocational training, there are other factors which must not be overlooked in the interpretation of modern life. As we return to the question, is the future job

[2] See *New York Times*, Nov. 24, 1940.

[3] Eckert, Ruth E., and Marshall, Thomas O., *When Youth Leaves School*. McGraw-Hill Book Co., 1939. See p. 39

[4] *Op. cit.*, p. 303.

[5] *Op. cit.*, p. 193.

[6] "Vocational Laxity," *New York Times*, Dec. 15, 1940.

[7] Bryan, John E., "Youth Learn Manual Skills," *Education*, 61:2 Oct., 1940.

[8] See *New York Times*, Dec. 24, 1940, p. 13.

[9] Shuder, H. A., "Training in Jobs, Prisoners' Needs," *New York Times*, Dec., 1940.

to be the thing of first consideration in schooling? Among these factors are the developments in science and the resultant new industries of the past decade. This short period has given us great transports flying the stratosphere and spanning the oceans. It has given us thousands of miles of superhighways over mountains, under rivers and peaks, and across the plains, so that the very meaning of "community" has changed. Washington and Buffalo are now ninety and one hundred minutes from New York City respectively. Chemistry has already obviated the need for Muscle Shoals as a nitrate plant, and of rubber plantations for any purpose. Textiles and vitamins are now available through its magic. Great aqueducts and dams have been constructed to furnish water for power, for human use, and to irrigate fields. Evidence of change was never so great. Raw materials have increased manyfold and have brought dozens of new industries and processes. All of these are significant in any long term program, if it is still safe so to plan, when obsolescence seems always just around the corner.

Confronting us now is the enormous Defense Vocational Education Program coincident with a National Defense Industrial Revolution. Launched with the signature of the president to a bill appropriating $15,000,000 the last of June, 1940, vocational classes began immediately for the training of 70,000 youths and adults as workers in defense industries and services. New appropriations followed and the original program set up for July and August was extended to July, 1941. Additional appropriations have made possible a further extension and expansion of the program.

Starting from scratch and with many features of the program to be initiated by local directors, the plan has matured to the extent that along with courses for students are now developed professional courses for teachers. An extensive system of local, state and national administration is already under way. The NYA has been included with a special program of training under the title: National Defense Vocational Education for NYA Youth on Work Projects. Budget estimates for 1941 include operation expenses and new equipment ostensibly to provide national defense industries with workers who have some mechanical skill and some knowledge of production, yet also to give youth employment and thereby make them self-supporting. All available school shop facilities are being taxed to the limit and all-night shifts operate in many places in order that no time will be lost in the original defense plan.[10]

Significant with the National Defense Vocational Education plan are certain methods and class size, which if valid, make regularly constituted day school plans look wild to say the least. What would most day school teachers think if they were asked to keep class size down to around ten, and further to buy all the supplies needed to do a first rate job of teaching? These are the order of the day when the government puts on a program where the utmost outcomes are to be secured.

Significance of College Preparatory Courses

Charles Fries,[11] professor of English at the University of Michigan, points out that of the 72,215,000 adults in the United States in 1935, 48.4 per cent had not completed the 8th grade, 86 per cent had not completed the high school, 4.88 per cent were completely illiterate, and but 2.9 per cent were college graduates. One is forced to ask, "What about those college preparatory courses that everyone has been made to take when they were designed for less than 3 per cent of the population? And what significance have the other figures?".

When schooling terminated for nearly half of the population before completion of the 8th grade and for ¾ of it before completion of the high school, an audit of curriculums should show that those responsible had these facts well in mind. Unfortunately, extensive audits show that schools have for the most part set up a system of requisites designed for the 2.9 per cent who were to be college graduates. The other 97.1 per cent seemed to have dragged along until the law released them to seek apprenticeships, or correspondence courses, or perhaps to drift aimlessly.

It would seem that democratic society should assure to patrons of the school the right to expect their children to be equipped for some level of participation in the world's work commensurate with the time and monetary costs experienced. The outcome of school experiences (or should one say lack of experience), as shown by the large numbers of unemployed has proved such to be not the case. Schools are accused of being undemocratic, and our secondary schools readily admit, with pardonable pride, that their curriculums are so planned that graduates are admitted in full standing to this or that college. But again we are forced to point to the large numbers of students who do not complete the academic high school course and to ask with the Regent's Inquiry, "What about them?"

But if future employment is to be a specific outcome of schooling, what job areas are worthy of consideration in the school setup? Mention has already been made of a number of new industries due to advances in science. Up to the middle of the year 1940 the building of air transports was going forward at a rapid rate but could not keep pace with the demand. With the undertaking of National Defense, bombers and fighters have been ordered in such quantities that literally thousands of workers will be needed beyond present staffs. Machinists, riveters, layout men, fabricators, and assemblers are already needed faster than they can be trained. The artificial fiber industry, in fact the whole great textile industry, artificial rubber, plastics, glass, light metals industry, the foods industries, and transportation, especially trucking, all appear to be worthy of long term consideration beyond the present defense demands.

What Must Be Known to Get a Job

Aside from purely shop jobs indicated by the above, there will be need for thousands of clerks, secretaries, sales people, and maintenance persons in these industries. There will also continue the demand which now exists for many thousands of government employees. Albert H. Hall, Chief of the Bureau of Public Service Training, at Albany reports[12] 4,500,000 persons in the United States are now employed in federal, state, and local government on an annual pay roll of $6,000,000,000. In order that persons can be secured who are competent for the government jobs in New York State, schools have been set up and training was given to 28,930 aspirants last year.

If the job's the thing of first importance, what do young people need to know to get one? Again we may turn to the Regent's Inquiry where we find, aside from necessary knowledge and skill to manipulate materials and perform operations, a large number of youth now in employment state that a knowledge of English use was very helpful in getting and holding jobs. Related subjects like mathematics, science, and drafting, or a knowledge of blueprint reading are other essentials. Obviously, industry and courtesy are other factors. Thus, a great need has been shown to exist for special vocational training.

The Smith-Hughes law has been the greatest single factor in plans which have matured for vocational classes. Under its operation one half the pupil day is spent in the shop to learn trade fundamentals and skills and the rest of the day in social studies, English, and related work. Surveys of industrial needs indicate the kinds of jobs to train for, and shops may be kept equipped accordingly. All of this seems simple enough and one might question any dilemma, if several problems did not arise.

First there is always the possibility that the boy or girl who registers for any specific vocational training may be throwing away an opportunity for a great professional career, though surveys of school outcomes show this chance to be small compared with the one where the boy or girl who registers for a professional career throws away a chance for a successful life in industry. The unfortunate thing is that in spite of careful guidance there must still exist this element of chance regarding

[10] School and Society. 52:1348, Sat., Oct. 26, 1940, p. 389.

[11] C. C. Fries, "Educating for Frustration," *School and Society*, 52:1353, Sat., Nov. 30, 1940, p. 537.

[12] Hall, Albert H., Annual Report to Associate Commissioner Lewis A. Wilson, Aug., 1940, p. 1.

what is best for a child's future. However, exhaustive surveys of educational outcomes and possibilities now help to lessen the chance that wrong choices of a career will be made. Where such occur, parental hopes and tradition will be largely responsible. Secondly, there is an employing age level below which employers will not consider youth. Child labor laws and labor unions prohibit ready entrance of high school boys and girls in industry. Thirdly, we have accumulated a large psychology to the effect that it is wrong to force any child to select any kind of vocational training until he is old enough or until he has background enough to know what is possible in industrial fields and what he would like best to do. Part of this psychology rests on the fact that few adults actually knew what was to be their life's work until they were twenty-five, and many never knew from one year to the next what they would continue to do for a living. Furthermore, it has become almost inconceivable that a child could learn a trade because of physical and mental immaturity. Many of us have subscribed to this idea forgetting that we who grew up on the farm learned all of the agricultural occupations, and very thoroughly before we got through high school. Likewise if we grew up in our father's garage, or his planing mill, or his store, or in a lumber camp, an apprenticeship was served in spite of ourselves, the knowledge and skills of which have often given us assurance at times when education may have seemed on the rocks. However, most of us believe that there is much to be said on the side of normal development. This and the other factors just mentioned make pretty certain a prevocational period as essential up to one or two years prior to the school leaving age when vocational training should be entered by all who desire it.

Exploratory Courses

Like the academic courses planned for those who will go to a liberal arts college other courses need to be available which will lead in the direction of vocational choice and finally preparation for it. Serving this purpose in an admirable fashion are junior business courses; courses in foods and clothing; courses in gardening, horticulture, and stock raising; courses in commercial art; and courses in industrial arts. These courses have been received with such alacrity by pupils as to alarm schoolmen and patrons who are still wont to think of them as frills and fads in spite of 50 years of emergence. Most of these courses are so planned that there is wide opportunity for exploration with materials, and processes of modern social life, and therefore give excellent backgrounds upon which to base future vocational choices, and in addition they furnish many other highly desirable outcomes of living. In many of the activities of these courses one finds ample opportunity for developing the aesthetic sense through an appreciation of quality, of outline and color. There is the development of poise through the satisfaction of discovering abilities to create with one's own hands and from one's own ideas. There is the opportunity to acquire a respect for one's fellows as problems which arise in the shop are seen to be mutual, and as different views on solving them are compared.

Most of these courses lend themselves to any degree of ability which the child may possess or that his physique may require. Consequently they are the most natural outlets to pent up desires to participate in the work of grownups, and if properly co-ordinated with academic subject matter, furnish the best possible backgrounds for understanding class discussions or the printed page. The abstraction and formality of the classroom are dissipated and interest and incentive become apparent. Therefore, such courses are seen to rest on the soundest of psychological principles. They are also seen to be basic in any well-ordered future employment plans.

Since exploratory programs in the schools make use of the materials and processes of business, industry and the home, one finds equipment, shops and laboratories patterned after those required for production. In fact specific vocational training may make use of the same school setup for some areas as one finds for industrial arts. Likewise the home-economics laboratory might be used for trade dressmaking courses or vocational homemaking. Since the difference between the two types of training lies in method and in emphasis rather than in the basis for subject matter, and since the equipment and supplies needed for the industrial-arts and vocational shop courses are much alike, it is logical for economical administration and for co-ordination of outcomes that the work head up under one person with assistants for the different areas depending upon the size of the school unit, assuming, of course, that the administrator or director is properly grounded in the objectives, methods, possibilities, and outcomes for the various areas of training. The same advisory board members that are appointed for vocational programs are found valuable in exploratory settings. The same small tools, utensils, supplies, and, to a considerable extent, equipment, are employed in both situations. Industrial arts makes use of industrial procedures for learning, while vocational programs make use of industry for patterns of training in order that employment will be assured their trainees.

In conclusion, industrial arts and specific vocational training have sprung from similar pressing social needs. They have been separated by professional jealousies on the part of those who have not understood the criteria on which both must rest, and by the age-old controversy between those who would have the schools train for polite society and those who would have them concentrate on preparing students to secure and hold jobs. Thus the criteria of *purposes* and *outcomes* have been major determiners of relationship.

Data have been presented to show that the tax dollar has been spent for the most part on the kind of schooling designed for the relatively few who will graduate from college, and that while everyone took the courses out of necessity, for most they led nowhere. The resulting unemployment frequently ended in crime and the penitentiary, whereas by contrast many of those with marketable skills were employed in the worst years of the depression. National-defense industries were shown to require thousands, and while there are thousands who would gladly take the jobs, they are wanting in knowledge and skills required in industrial processes.

The Need For Industrial-Arts Courses

While specific vocational training was shown to be necessary to eliminate and obviate unemployment, as well as to produce interested and efficient citizens, it was also pointed out that such emphasis in the schooling of the majority need not be incompatible with ideals which we have long wanted children to possess. Psychologically, the child develops by, and his interests and abilities expand through, many years of exploratory experience with nature and with man-made materials and processes. During these years the industrial arts are very important in furnishing firsthand information about the world of the grownup. They satisfy the urges to do something — to create with one's own hands, and to know about the activities of the social order in which they will ultimately participate. They therefore give the child a chance to discover vocational interests and abilities and give him some training preliminary to more specific preparation for the employment he may finally desire to undertake.

Academic subject areas are not to be minimized in an adequate plan of schooling, but need to be rethought or planned so that they will contribute directly, as do the vocational and industrial-arts areas, to the abilities required to earn a living and to understand and appreciate the social order which makes this possible.

Never let it be said of an American youth what H. L. Tomlinson in the April *Atlantic* said of the young Nazi who "in his teens roving the night, not sure of his whereabouts but anxious to drop his load and get home, who knows nothing of history before 1933 and cares nothing, and nothing of the spirit except Hitler's and wants to know no more, blasts to dust the best the centuries have given us. The burial of the dead after one raid by night on Coventry occupied much of a week, and incidentally, that city lost its cathedral, an exquisite example of a Gothic that was England's own."

That these ideas now prevail is seen in statements of Dean Francis Spaulding on the night of February 11, when he spoke

at the forum on National Defense at Yale, urging a reappraisal of educational courses in the public schools, and asserting that the existing courses are impractical.[13] John Erskine's article in the January, 1941, *American* in defense of industrial education in the schools, and Dorothy Bromley Dunbar's "Education for College or for Life," in the March, 1941, *Harpers*, are other examples of current ideas of the responsibilities of the schools and the contributions seen for industrial arts and vocational education.

[13]*New York Times*, Feb. 12, 1941, p. 8.

Finally, we must go back to the beginning and say relationships spring from ancestry. Industrial arts and vocational education have a common ancestry. They accomplish their objectives through common setups to equipment, and similar supplies and laboratory provisions may serve them both. In the end, they have a common goal — the goal herein advocated for most schooling — that of preparing boys and girls to earn their living and to be happy and efficient citizens. In the acquisition of these goals we would have everyone cognizant of ultimate relationships which must exist in all one does. Let us remember with John Donne of England, who wrote three centuries ago:

"No man is an Iland, entire of itselfe; every man is a peece of the *Continent*, a part of the *maine:* if a *Clod* bee washed away by the SEA, EUROPE is the lesse, as well as if a *Promontoire* were, as well as if a *Mannor* of thy *Friends* or of *Thine Owne* were; any man's death diminishes me, because I am involved in *Mankinde;* and therefore never send to know for whom the bell tolls; It tolls for *Thee.*"[14]

[14]Hemingway, Ernest, *For Whom the Bell Tolls.*

Objectives of Industrial Education

A. F. DODGE*

The aims of Industrial Education vary according to the type of industrial education under consideration. The accepted way of dividing this field is into two main divisions, industrial arts and vocational industrial education.

Industrial Arts

The most authoritative statement of aims for industrial arts is that prepared by the Committee on Standards of Attainment in Industrial Arts Teaching of the American Vocational Association. This statement, including twelve separate aims or objectives, has been very effective in helping to shift the emphasis of shop teachers from the mere development of skills to other worthwhile objectives.

On the other hand the inclusion of *twelve* separate objectives — more than can be counted on the fingers of two hands — may have a tendency to confuse shop teachers. Shop teachers who study this statement of objectives find they can justify practically everything they teach by one or more of these officially approved objectives. Is it not possible that such shop teachers may conclude that their courses are satisfactory just as they are, with the result that no changes are made and no improvement or progress results?

Aims and objectives are intended as guide posts to intelligent effort in any activity, and if they do not serve such a purpose they are of no value. George Bernard Shaw has said a fanatic is one who, having lost track of his objectives, redoubles his efforts. Now there is no surer way of losing track of one's objectives than by trying to follow many separate objectives at the same time. It seems probable that the A.V.A. committee which formulated these twelve objectives never expected any teacher to strive for all of these objectives in any one course. The purpose of objectives in connection with a course of study is to serve as guide posts for the intelligent selection of appropriate subject matter and methods. Even two objectives for a given course would be confusing if the two objectives had little in common.

Let us consider two of the A.V.A. objectives, the first and the twelfth as examples:

(1) To develop in each pupil an active interest in industrial life and in methods of production and distribution.

(12) To develop in each pupil elementary skills in the use of the more common tools and machines, and a knowledge of the methods of procedure in tasks frequently encountered by the average man, together with a knowledge of the working qualities and characteristics of some of our most used materials.

These two aims are widely divergent and would require entirely different subject matter. Two separate courses would make it possible to attain one objective in one of the courses and the other objective in a second course. Such an arrangement would also allow boys to choose such courses as were in line with their own interests.

It is the writer's contention that we shall never have really effective industrial-arts courses until we bury the idea of multiple objectives — organizing all subject matter within each course for the most efficient accomplishment of one specific major objective.

In the early days of industrial education there was even more confusion than now with respect to objectives. Then there was no clear distinction between industrial arts and vocational industrial education. The aims and objectives of both of these types of shop courses were all scrambled together and offered as the objectives of the early shop courses. Today we think more clearly on the subject and organize our courses more effectively because we recognize these two separate fields and set up courses, the objectives of which are confined to only one of these fields.

In the future we will continue to clarify our thinking and improve the effectiveness of our courses to the extent that we recognize that the present field of industrial arts is too broad to be considered as a single field of instruction. We must therefore break up this broad field of industrial arts into several clear-cut areas and offer specific courses within each of these.

Further elaboration is probably necessary in connection with the foregoing statement:

(1) Objectives are of two types, those pertaining to skills and knowledge and those pertaining to attitudes.

(2) As guide posts for selecting course subject matter, only those objectives pertaining to skills and knowledge need be considered.

(3) An analysis of the twelve A.V.A. objectives reveals only five which pertain to knowledge and skills, and

(4) Many of the larger schools have already set up specific courses which seem to have as their objectives one and only one of these knowledge-skill objectives.

Of the A.V.A. objectives seven appear to relate to attitudes and only five to knowledge and skills. These five relating to knowledge and skills indicate the subject matter for the courses and seven relating to attitudes indicate the *methods* which should be used in teaching the knowledge and skills. In other words certain skills and knowledge are necessary in order for individuals to take their proper place in society. These skills and this knowledge form the *subject matter* of our course. Then these skills and this knowledge must be taught in such a *manner*

*Associate Professor of Industrial Education, University of Illinois, Urbana, Ill.

that desirable attitudes will be developed. In fact this is the only effective way to develop desirable attitudes — in connection with the learning of skills and knowledge which the student uses in his out-of-school life. Preaching is ineffective and attitudes acquired in connection with *school* activities may not carry over to supposedly similiar situations outside of school. Hence only the five knowledge-skill objectives of the A.V.A. need to be considered in determining subject matter. The seven attitude objectives will be of value later in determining the *manner* in which this subject matter should be taught.

The five objectives pertaining to skills and knowledge are as follows:

(1) To develop in each pupil an active interest in industrial life and in the methods of production and distribution.

(2) To develop in each pupil the ability to select, care for, and use properly the things he buys and uses.

(3) To develop in each pupil the appreciation of good workmanship and good design.

(11) To develop in each pupil a knowledge and understanding of mechanical drawing, the interpretation of the conventions used in drawings and working diagrams, and the ability to express his ideas by means of a drawing.

(12) To develop in each pupil elementary skills in the use of the more common tools and machines, and a knowledge of the methods of procedure in tasks frequently encountered by the average man, together with a knowledge of the working qualities and characteristics of some of our most used materials.

As already stated, many of our larger schools have organized courses which appear to aim specifically at a single one of these knowledge-skill objectives. For example we immediately recognize No. 11 as the major objective of mechanical drawing courses. Our so-called home-mechanics courses seem to aim specifically at objective No. 12. The guidance value of objective No. 1 is stressed by the A.V.A. committee, and certain schools have set up courses which seem to have this as the major objective. The most effective of such courses are those which require experiences in several unit shops immediately preceding the choice of a particular *vocational* course. It is more difficult to point specifically to courses which have objectives Nos. 2 and 3 as their major objective. However, both of these objectives seem to relate rather definitely to consumer values and our general shops and industrial-arts laboratories as usually organized seem to aim at consumer values as one of their more important objectives.

To summarize, the writer believes that a well-organized industrial arts *program* will provide for the attainment of all of the twelve A.V.A. objectives, but he believes that these objectives can be attained best by organizing separate courses each having but one of the five[1] knowledge-skill objectives as the major objective. It would probably be desirable for each pupil to take several of these single-objective courses, but under the plan of specific objectives for each course he would take each course at a time when the objective for the course was in line with his interests and capacities.

Vocational-Industrial Education

The objective of vocational-industrial education is to prepare for entrance into a specific trade or industrial occupation or to prepare one who has already entered such an occupation for advancement in that occupation. Courses or classes which prepare for entrance are called *trade preparatory* and are found almost exclusively in full-time trade or vocational schools. Classes which prepare for advancement are called *trade extension* and are scheduled as evening or part-time courses so that the student may continue to hold his present job while attending school.

The statement of the objective of vocational-industrial education seems very simple until we begin to study it in terms of present practices in vocational-industrial education. Let us first consider practice in pre-employment trade preparatory courses, since such courses have been especially subject to criticism. For example should trade preparatory courses attempt to train journeymen or should they train only for jobs in the lower levels of the trade? One practical way of answering this question is to point out that no trade school has been successful in an attempt to turn out competent journeymen, although some of the better trade schools have become so efficient that employers have accepted the school course as equivalent to one or even two years of apprenticeship. Also we know that only those things can be effectively taught for which the learner sees immediate values and which he immediately begins to use. So perhaps it is better that full-time trade preparatory courses be relatively short, two years or even less, attempting to prepare only for a lower level in the trade. Then after the individual has entered the trade and finds a need for additional skills or knowledge, evening or part-time classes should be available to help him reach the level of journeyman.

Let us next consider whether trade preparatory courses should be narrow or broad. Certain critics claim that vocational courses are much too narrow — training for a single specific job only. They call attention to the rapid technological changes in industry and urge that the training be such that the pupil will be able to adapt himself to the changing situation. Everyone admits the value of the ability to adapt to changing conditions but there is considerable disagreement as to the method by which the school may help the boy to acquire this ability.

Leaders in the vocational-industrial field are inclined to argue that this ability to adapt to changing conditions is best secured by teaching a boy a *whole* trade, for example, the trade of allround machinist rather than the job of lathe or drill press operator. A whole trade well learned, including a thorough understanding of the theory back of the trade processes, should go far toward developing the ability to adapt to changes within the trade.

Some from the field of general education claim that no attempt should be made to teach a trade in the full-time school. One educator has said: "Today factory workers should be taught not one trade but the basic operations of industrial production as a whole." It is not perfectly clear what are the "basic operations of industrial production as a whole," but it is suggested that a knowledge of these basic operations may be taught by giving the pupil experiences with a wide variety of tools and materials. Leaders in vocational education also believe in the value of this wide acquaintance with tools and materials which they believe should be acquired through industrial-arts courses, but they believe these courses should be followed by some specific trade training. A conservative statement of this point of view is quoted from the Regents Inquiry: "By the final year, and this does not necessarily mean the twelfth year, the pupil should receive some specific training to develop definite marketable, salable skills."[2]

There may appear to be some conflict between the conclusions arrived at in the preceding paragraphs: first, that the full-time school can prepare only for the lower levels of a trade, and second, that the training of a boy entering trade and industrial occupations should be broad. This apparent conflict is due to the fact that it is impracticable for the full-time school to turn out competent journeymen and on the other hand it is undesirable for the school to give narrow specialized training to individuals capable of becoming skilled tradesmen. The full-time trade school must therefore follow some middle course. The following suggestions are an attempt to indicate some principles which might be observed in following such a course:

1. Expect the general high school to provide, through industrial-arts courses, a wide acquaintance with the materials, tools, and process of industry.

2. In the first year of the trade course assign work involving the more common and fundamental operations in all phases of the trade for which the pupil is being prepared and require a thorough understanding of the theory related to these operations.

3. In the last year of the trade school

[1] Four if objectives 2 and 3 are near enough alike to be considered as a single objective.

[2] Norton, Thomas L., *Education for Work, The Regents Inquiry*, McGraw-Hill Book Co., 1938, page 193.

provide enough repetitive training in at least one or two occupations in the lower levels of the trade so that the pupil will acquire a marketable skill in these occupations.

Another question to consider is our policy toward training for the semiskilled trades. Should trade preparatory courses train only for the skilled trades as is largely true at present or should training also be offered for semiskilled trades? Before 1917 it was pointed out that schools were being maintained at public expense to train our future doctors, lawyers, teachers, and even stenographers and typists, but that practically nothing was being done in vocational preparation for those who were to work with their hands. The Smith-Hughes law was accordingly passed in order to make our schools really democratic by offering vocational training to all. If today vocational schools cater to our future tradesmen and neglect those who are to become our semiskilled workers they are guilty of the same undemocratic attitude that was criticized in the schools of the earlier period. Therefore, if our schools are to be democratic we must provide occupational training for all. Just what type of training should be offered as preparation for semiskilled trades is a disputed question. Perhaps well-organized industrial-arts courses, which provide experiences with a wide variety of materials, tools and operations, are the best and only practicable type of school training. But the writer believes that the school must do more than this. If it is impracticable for the school to teach the specific skills involved in many of the thousands of semiskilled occupations, it is still the duty of the school to help each boy find a job in some occupation for which his industrial arts experiences have indicated he has an interest and aptitude. It may be objected that this job placement is not vocational education. But if it is not, it is still so closely connected with vocational education that the vocational-industrial school which evades this duty of job placement will soon be left behind by the rapid advance of industry and in a few years will be teaching operations, processes, and even occupations which no longer are practiced.

Trade extension courses, those designed to promote the efficiency of individuals already working in the trade, are of two types: evening classes and part-time classes. Evening classes are planned primarily for the upgrading of journeymen. Part-time trade extension classes held during the working day, usually for 4 to 8 hours per week, are intended for apprentices or other youths already working in the trade.

Organized labor has always had a favorable attitude toward all types of trade extension courses. Two major causes may be responsible for this support. First, it is impossible for the school to start and carry on such trade extension courses without first selling them both to labor and to employers. Second, organized labor has always fought for greater educational opportunities for the common people.

How then can we explain organized labor's rather hostile attitude toward the full-time trade preparatory courses? A study of publications and speeches of labor leaders discloses three major criticisms. First, there is fear that an oversupply of workers may be trained in certain trades. Second, there is the fear that products of these classes will be sold in the open market and thus reduce the work opportunities of union members. Third, organized labor resents the fact that the schools often organize and carry on such courses without seeking the advice and cooperation of labor.

Leaders in vocational education believe that no effective training is possible except through the production of marketable goods but it is their belief that the amount of such goods is negligible in comparison to commercial production and that such goods can be disposed of without an appreciable effect upon the labor market. A quotation from an official publication of the American Federation of Labor indicates a very near agreement: "To get real vocational training, the pupil must produce things that are up to market standard — What then is to be done with the product? The answer may be different for different occupations, but should be worked out by the school, the industry and organized labor in joint conferences."[8]

With respect to the third point, the U. S. Office of Education is in perfect agreement with organized labor. Why so many vocational schools fail to set up the local advisory councils recommended by the U. S. Office of Education is difficult to explain. No doubt such councils require considerable tact to organize and deal with, but so do parent-teacher associations. However, it seems logical that the school should benefit from both of these organizations. Theoretically, at least, the local advisory council should be a very valuable means of keeping the school in touch with the needs of industry as well as of selling the vocational school to both employers and labor.

It is the writer's belief that, if the third criticism of labor against our full-time vocational courses could be removed by setting up local advisory councils, then the first two points of criticism would soon be forgotten. For example, in one of our large cities where the vocational program has been carried on in close cooperation with organized labor, one union of its own initiative demanded that its future apprentices must attend the vocational school full time for six months before they actually begin work as apprentices.

[8]Guide for Vocational Education, American Federation of Labor, 1938.

Assembly, Santa Barbara's New Industrial Division, Santa Barbara, Calif.
E. E. Ericson, Director

Behind and Before

DEAN M. SCHWEICKHARD*

Directional Aids

The turn of a moment, an hour, a day, or a year is a dividing point between what has been and what is to be. A review of what has been reveals some areas of satisfaction and others which could have been improved upon. What is to be is just as much of an uncharted sea as was the Atlantic Ocean to Columbus. He set forth with such limited knowledge of old world geography as had been accumulated up to that time, combined with the belief that the earth was round. He thought he knew where he was going but arrived at a new destination previously known to no one in the civilized world. Many unforeseen circumstances arose, even threatened mutiny on his ship, but he went ahead because he had the ability to cope with each new occasion as it came.

Not only in his time but always, the world has been full of questions — myriads of them. In times of tranquillity we pay little attention to most of them, but in times of crisis they seem to be flying about our heads and all demanding an answer at once. Their very multiplicity confuses us, and we feel a sense of helplessness in attempting to cope with any of them.

There are those who would come to us with a plausible solution for the complicated tangle of international affairs. The plan proposed by some would lie entirely within the military realm, while others seek the answer in readjusted channels of trade. These are all-important things to which we shall have to attend and in which we shall have to engage, but it is the determination of the ends toward which these things propose to lead us that deserves our most careful consideration.

The radio, the newspapers, and the magazines are full of what is happening, or what someone thinks will happen or should happen. Before proceeding into a new year would it not be well to pause in the midst of all this strife and turmoil to take stock of what it is we are seeking to secure or to preserve. At best, we are like the aviator flying blind who would get nowhere if he had not first determined his destination. Knowing that, he must then have the necessary instrumental aids to guide him.

A Condensed Analogy

Relics of domestic, agricultural, and primitive industrial life upon the earth present a picture of human existence with diminishing certainty for a space of about five thousand years in the past. Some scientists believe there is evidence to indicate that human life existed even as long as five hundred thousands years ago. For purposes of comparison, this entire span of human history has been likened to an imaginary man who today has attained his fiftieth birthday. In the figure, each year of his life would represent ten thousand years.

According to the same calculation, he reached the age of forty-nine years before he learned to plant seeds and harvest crops by hand and to tame a few of the wild animals for service or companionship. Six months later, he invented writing; and in three months more — at forty-nine years and nine months of age, he wrote his first books.

Only two months ago he adopted the Christian religion. Two weeks ago he invented the printing press, and almost a week ago the steam engine. He has been traveling around in steamships and railroad trains for two days. Yesterday he discovered what electricity could do. This morning he learned to navigate under the water and in the air. This afternoon he has mastered the ether waves to help him reproduce sounds and sights in remote parts of the world.

In this comparative last year, man has emerged from a state of savagery into what is looked upon as civilization and has learned to master the forces of nature, engage in trade, use money, write, print, have schools and churches, and invent marvelous devices for his ease and comfort. These are the things which are behind. What lies before? If man continues to live in the years of tomorrow what will he be able to do? Have his accomplishments gone to his head so they will destroy him, or will the future bring greater security of human values?

Horizons Ahead

The boundless past and the limitless future are impossible to comprehend fully, but it is well to focus our attention upon the indications which seem to be apparent on our own horizon. In fancy there may appear to be glistening castles on the horizon which we would reach in a single bound, but in reality we must bear vividly in mind that the way which lies ahead will have to be covered with about the same amount of honest effort as the way behind us has taken. We have come over some sorrows and disappointments, and there are some lying before us. Likewise there have been some joys and successes, and some are sure to be ahead of us if we pursue them faithfully.

Even though the world all around us seems to be moving in enormous movements and sweeping along in great strides, we must not lose sight of the value of simple things and essential details. The designer of the gigantic airplane envisions his creation taking shape on the horizon of his thinking, but it does not come into actual physical being without an endless amount of minute detail. First the mathematical calculations must be computed; then follows the painstaking and accurate work of the drafting room to properly depict the exact size and form of each part and of the whole. The success of the final construction depends upon the continuance of the same scrupulous adherence to the countless details, every one of which serves an indispensable part in the entire structure. Industrial students and industrial workers have the importance of this kind of faithfulness impressed upon them constantly in their daily work, and so are preparing a firm path over which to proceed in the way ahead.

The horizon before us must be lighted by the glow of imagination if it is ultimately to break forth into the full light of a new day or a new year. The inventor, the explorer, the philosopher, or the scientist who brings new things into the grasp and comprehension of his fellow men does so because the fervency of his belief in the eventual existence of these things enables him to see them clearly in the dim distance that still obscures them from those about him.

As we stand on time's threshold peering thus into the future we shall see come forth an unprecedented development in the fields of science and industry. These two great eras of human activity are coming closer and closer to each other with every passing year. The present world emergency is forcing industry to call upon science more urgently than ever before for help in the production of new materials, the development of new methods, the discovery of new means with which to combat the enemies of mankind, and the creation of new devices for the preservation of the gains already made. These things are challenges to all who would press onward with the vigor and enthusiasm which when coupled with ability brings forth accomplishment.

If the sum of all the things which lie before us is to represent a net gain over the things of the past it must be the ultimate outcome of a better balance of values. We will need to eliminate the artificial barriers between the kinds of human service which are considered of most worth, and allot to each its full share of credit. Undue emphasis upon one will mean the sacrifice of another. So may we seek a well-rounded development of the material and spiritual forces of our nation which will make for unity and solidarity. If this is the sort of horizon toward which we move in 1942 we shall find our land to be one where opportunities are more wisely used and where freedom and right are ever more highly prized.

*Assistant Superintendent of Schools, Minneapolis, Minn.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION
John J. Metz, Editor

An Unfair Criticism

An editorial entitled "Trade Education Versus Culture," in the December issue of one of the national magazines, takes the public school to task severely for not having trained the million of skilled mechanics now so sorely needed. The editorial further states that an odium has been attached "to attendance at the few so-called 'trade schools'" which repels youngsters who would seek their future in the industrial world.

Statements like these are somewhat difficult to understand, because reputable trade schools, and full-time and part-time vocational schools are not few in number, and wherever they have been established, they have had considerable commendation from local residents, industry, and labor. The graduates of these schools, too, have been found excellently trained, especially when one considers the actual school time they put in on the practical work of their trade.

Apprentice training, where industry, labor, the school and the state work together, has been found very efficient, and thousands of good mechanics have been prepared that way. During the depression years, however, industry did not need workers and it saw no reason why it should train apprentices. The school attendance required of the apprentice in training is but four hours per week, the rest of the week being put in on the job. If industry does not see fit to employ apprentices, the school can do nothing about it.

The trade schools, and other schools where shop courses are taught, were in a precarious position during much of the past 10 or 12 years. Taxes for all school purposes were severely cut, and hence shopwork of almost every type had to be curtailed, even in vocational schools that had proved their value as training centers for preparing skilled mechanics.

In plain words, the schools had been hamstrung, and were not permitted to do their work, and industry and the industrial leaders contributed their share to the hamstringing. Assuming now that the schools had been given the means for preparing the million of skilled mechanics mentioned in the editorial referred to, and assuming that this training had been carried on throughout the past 10 years, what would these trainees have done with their skill when industry could not employ them? How much of that skill would have been lost because of the nonuse of what the learners had acquired?

Little is gained by blaming any human agency for the frightful mess in which the world finds itself embroiled at present. We might just as well deplore the fact that the arsenals and ammunition makers had not been working three shifts per day since 1925 to produce the guns, tanks, airplanes, ships, and other war material which are so badly needed now. Had they so worked, would those materials be up-to-date now, or would they be superannuated.

The thing to do now is for everyone of us to do the best we can. The schools are doing an excellent piece of work training both the semiskilled who are much in demand, and the skilled whose training, of course, will take time. The adaptability of the schools, and the speed with which they put on the defense training program, deserves commendation. The fact that many vocational schools throughout the country are running 24 hours per day, shows that the school is fully aware of its opportunity and is doing its best to help in this emergency. Probably if it were commonly known that the schools of this country are at present giving defense training to more than one million students, critics would not be in such haste to place blame where praise is deserved.

National Defense Savings and the School Shop

There are many divergent views on what to do in order to save our democratic way of life. There are those who predict dire consequences if the "all-out" efforts of this country are not put into effect at once. There are those who advocate assisting England to the greatest possible extent without sending American troops abroad. There are still others who maintain that full help should be extended both to England and to Russia, while another group holds that no aid at all should be given Communist Russia.

Unfortunately, there is no common denominator which can be applied to these various trends of thought. All can readily see, however, that our country must be prepared for future eventualities, be they what they will.

It has been shown that our country is very meagerly equipped to defend itself against any aggressor. This, as has been amply demonstrated by the happenings in Europe, is an exceedingly hazardous position for a nation to be in. Whatever, then, our ideas are about the question of entry or nonentry of our country into this international upheaval, we can all see the necessity of being fully prepared to defend our liberty should that become necessary.

To thus prepare our country requires money, and this money must be obtained in one way or another from those who enjoy the blessings of the liberty that has been and still is ours. Taxes — yes they will be assessed to raise some of the money, but because taxes alone will not suffice, the National Defense Savings Program was inaugurated.

Entering wholeheartedly into the service of developing understanding and interest in this program, and in creating a spirit of self-sacrifice in young and old alike, is within the scope of our educational philosophies.

The school cannot hold aloof when it comes to such vital questions which bear on the life of the nation. The shop teacher, too, must do his share in preparing students to thoroughly understand Lincoln's prayerful Gettysburg address, that this our ". . . government of the people, by the people, for the people, shall not perish from the earth."

During the depression, many of our people lost all ideas about thrift. They came to look upon the government as the generous father who would provide. It is high time that the old-fashioned virtues of industry and thrift be reinstated, and the school, and especially the school shop, can contribute much in fostering an understanding of both of these vital factors in making life worth-while.

It is well then that shop teachers should take a very active part in making their pupils see the value of the National Defense Savings Program. It is a means whereby the student can take care of a civic duty, help himself economically, and at the same time acquire a habit which will be of immense value in later life.

Spatial Perception Tests for Determining Drafting Aptitude

JOHN EDMUND CRAWFORD*

Aptitude testing is coming into its own, in the present emergency. Industry and school alike have awakened to the necessity of efficient personnel selection. The manifold advantages accruing from proper aptitude testing plus careful interpretation of these data need no lavish advertising to attract administrators who seek to eliminate wasted apprenticeship and failure.

Psychologists are ready for these new demands on their services. Scientific procedures have replaced crude methods of earlier years, and trained professionals have taken over testing from the amateurs. Drafting is just one of the many technical areas that are being measured these days, to reduce failure and mediocrity.

The research reported here did not overlap such investigations of drafting aptitude as that of Badger,[1] Castle,[2] and others.[3-9] The findings of this present study are somewhat in agreement with those of parallel studies by Horning[10] and Stoy,[11] but rather expand all these earlier theories into more practical data for use in prognosing advanced mechanical drafting aptitude.

The Present Research

Probable basic determiners of machine design and detail drafting were defined and submitted to leading psychologists, engineers, and designers for agreement, as a beginning in this study. Then available tests were sought to measure or indicate these basic determiners. These tests were chosen on the basis of their validity and reliability, with additional consideration for their eventual use by persons other than psychologists. All this preliminary work was based on the premise that aptitude such as that for machine-design drafting is not cast en bloc, but rather is made up of a number of special aptitudes over and above what we may call general intelligence. This theory is in general acceptance by psychologists today.

The trial battery of tests was given to a large group of young men registering at Carnegie Institute of Technology, for a course in machine design and detail drafting, under the new engineering defense training setup. The cases included in this study were delimited thus:

1. *Age range:* 17 to 26; mean was at 22 years.

2. *Education:* high school graduation, but no further formal education. The mean for the group on the Carnegie Mental Ability Test was slightly above that for high school seniors, but somewhat below that for engineering freshmen at Carnegie Institute of Technology.

3. *Economic status:* all were employed in industry, jobs ranging from clerical to technical work. None had drafting work, per se.

This course was equal to the regular day school course at Carnegie Institute of Technology in engineering drawing, based on French's *Engineering Drawing* text and the problems of *Engineering Drawing Sheets* by French and McCully.[12, 13]

At the close of this drafing course, marks were given to each student on the work accomplished. Each final mark was based on the mean of the student's grades on all his plates and special jobs produced. Scoring standards, against which each completed job was strictly marked, were the same as have been used in Carnegie Institute of Technology day school engineering drawing courses, and are probably as accurate and objective measures as is possible to obtain in such a course. These high standards are at least equivalent to the technical-industrial standards in machine detail and design in present-day professional use. This close likeness is important here, for upon this basis the aptitude test batteries may be applied as well to the trade and industrial apprentice problem as to the school problem of class personnel.

Course final marks were found to be spaced in uniform increments on a linear scale. This agreed with findings in previous years at Carnegie Institute of Technology. Therefore, in this study these final marks (the criterion scores) were given arbitrary values thus. $A = 5$, $B = 4$, $C = 3$, $D = 2$, $F = 1$.

The test scores from the trial battery which had been administered to the whole group at the beginning of the course were statistically analyzed to discover intercorrelations. Then the test scores were correlated against the final marks, providing further basis for assembling the *final* test battery. The individual tests in a battery should correlate large with the criterion and small with each other, for best efficiency of the battery as a whole.

From these correlation data, various test arrangements were calculated for their multiple R's with the final marks. For the purposes of this discussion, the details of the statistics involved will be deleted, and the more important results summarized for most practical use. Some of the inter-test and criterion correlations are shown in Table I.

Tests	N	Minn. Paper FB (AA)	Crawford Spat. Rel.	C-B Point Motion Test
Minnesota Paper FB (AA)	208		.258	-.093
Crawford Spatial Rel. Test	208			.340
C-B. Point-Motion Test	208			
Final Marks (Criterion)	80	.498	.410	.298
--corrected for attenuation		.588	.472	.350
Per Cent Efficiency*		29	23	16

* Statisticians usually advocate consideration of the attenuation of the r value, in calculating efficiency from the formula: $E = 1 - \sqrt{1-r^2}$

Table I. Correlations of some tests in the battery

The original report suggested the use of parts 4, 5, and 6 of the Carnegie Mental Ability Test (the number manipulation section of the test) in the final battery, along with the three spatial tests of Table I. This CMA-4-5-6 section correlates .350 with the final marks. However, at present this special section of the CMA test is not obtainable separately from the total test, which makes it more difficult and expensive to use than it may be worth in the battery. In a case where a measure of the mathematics aptitude is desired, a special test for this specific can be given in addition to the spatial relations tests.

The Spatial Tests in the Battery

The Minnesota Paper Form Board (revised form AA) measures the student's ability to put together the cut-out parts

*Somers Trade School, Pittsburgh, Pa.

[1]All footnote references refer to similarly numbered items in the bibliography at the end of the article.

of a design to make the correct whole design. It probably is predictive of ability to grasp bidimensional spatial relationships such as commonly confront the mechanical draftsman.

The Crawford Spatial Relations Test[14] measures the ability to rapidly assemble a described circular disk form on an irregular baseplate from nine different blocks which fit together on the plate in only one possible way. This test is probably predictive of ability to grasp tridimensional spatial or structural relationships such as commonly confront the draftsman.

The Crawford-Bennett Point-Motion Test (special form A for use in this battery) requires the student to predict the movement of one point in a mechanism from the prescribed movement of another point in the same mechanism. This test probably predicts mechanism insight or comprehension, a very important phase of thinking in machine design and detail drafting.

None of these tests are achievement tests, though aptitude and achievement tests may be similar. These three tests are not affected by the usual linguistic variations of a group of students. The partial correlations of test scores with the final marks, holding scores on the language manipulation parts of the Carnegie Mental Ability Test constant (subtests 1-2-3), are very little less than the "whole" correlations, as shown in Table II.

Test	Correlation with CMA 1-2-3-	"Whole" r with Final Marks	Partial r with Final Marks
Minnesota Paper FB	.385	.498	.495
Crawford Spat. Rel.	.206	.410	.393
C-B Point-Motion	.340	.298	.266

Table II. Effect of language manipulation on the tests

These data mean that the effect of language manipulation (at least as measured by the CMA 1-2-3 subtests) is so small that it does not appreciably affect the action of the tests in the usual English-speaking group.

The Regression Equations

In Table III are shown the regression equations which indicate the best methods of estimating the final mark which is most likely to be earned by a student in such a machine design course as the ND-800 Course at Carnegie Institute of Technology, from his scores on the three spatial relations tests in this battery.

The error of estimate $SE_{(Est.)}$ is a minimum when the regression equation is used for estimating final marks, X_1 from the given test data. The multiple coefficient of correlation, R, gives the maximum obtainable correlation between actual X_1 scores and estimated X_1 scores derived from the test data set into the regression equation. R is positive, no matter what the signs of the terms in the equation may be. Therefore, errors of sampling do not tend to neutralize each other but tend to become cumulative. As a result, the *PE* of the R is not a fair measure of the validity of any product-moment r. To test the validity of the obtained R, it should be compared with the value of the R which would arise from the same number of cases and the same number of variables, when these variables are uncorrelated and the R comes merely from the chance fluctuations of sampling alone. This chance R, calculated for the cases in this study, is very small:

Regression Equation	*Obtained R*	*Chance R*
3 (Table III)	.565	.158
4 (Table III)	.633	.194

These large ratios reflect the high validity of the tests used.

The regression equations furnish the ideal method of combining the tests; each test gets its correct weight according to its correlation with the criterion, independently of the other tests in the battery. Under these conditions the estimated final marks will have the least error of estimate, while the R will be as large as possible with the tests used.

Score Form	$SE_{(Est.)}$	R
1. $X_1 = .068\ X_2 + .40$	1.06	.498
2. $X_1 = .505\ X_3 + .38$	1.11	.410
3. $X_1 = .082\ X_4 + 2.57$	1.17	.298
4. $X_1 = .06\ X_2 + .38\ X_3 - 1.46$	.99	.565
5. $X_1 = .06\ X_2 + .24\ X_3 + .08\ X_4 - 1.36$	.94	.633
where: X_1 = Final Mark (A=5, B=4, C=3, D=2, F=1) X_2 = Score on Minnesota Paper Form Board (AA) X_3 = Score on Crawford Spatial Relations Test X_4 = Score on Crawford-Bennett Point-Motion Test (A)		

Table III. The regression equations

The coefficients shown in the regression equations 4 and 5 do not signify the true division of the load of prediction among the tests. In the equation 4 combination, the tests in the order shown share the load approximately 4:3. In equation 5, the tests as shown share the load approximately 5:2:3.

For most efficient use of these equations, facilitating tables have been devised whereby the raw scores from the tests may be easily transmuted into the estimated final mark. Table IV shows the score on a test when taken by itself which will most likely predict a certain final mark. But it should be carefully noted here that any single test is not as accurately predictive of the final mark as all three tests together.

Estimated Final Mark	Score on one Test only:		
	Minnesota Paper FB (AA)	Crawford Spat. Relations Test	C-B Point-Motion Test (A)
X_1	X_2	X_3	X_4
4.0	54	7.25	18
3.5	47	6.25	12
3.0	39	5.25	6
2.5	32	4.25	
2.0	25	3.25	
Example: For an applicant who scores 39 on the Minnesota Paper FB, the best estimate of his final mark in machine detail and design is 3.0 or C.			

Table IV. For predicting final marks in drafting from scores on a single test

Table IV is included here for convenience merely in rough estimates in certain cases where all data are not available.

Table V gives the facilitating data for use with the Minnesota Paper FB and Crawford Spatial Relations Tests, taken together as weighted in the regressing equation 4 in Table III. To use Table V, simply transmute the test scores into the weighted values W_2 and W_3, and add these values:

Estimated Final Mark $X_1 = W_2 + W_3$.

Minnesota Paper Form Board (AA)		Crawford Spatial Relations Test	
Test Score	W_2	Test Score	W_3
60	2.80	8.00	2.38
58	2.68	7.75	2.28
56	2.56	7.50	2.19
54	2.44	7.25	2.10
52	2.32	7.00	2.00
50	2.20	6.75	1.90
48	2.08	6.50	1.81
46	1.96	6.25	1.72
44	1.84	6.00	1.62
42	1.72	5.75	1.52
40	1.60	5.50	1.43
38	1.48	5.25	1.34
36	1.36	5.00	1.24
34	1.24	4.75	1.14
32	1.12	4.50	1.05
30	1.00	4.25	.96
28	.88	4.00	.86
26	.76	3.75	.76
24	.64	3.50	.67
22	.52	3.25	.58
20	.40	3.00	.48
Example: For scores of 50 on the Minnesota Paper FB and 6.50 on the Crawford Spatial Relations Test, the best estimate of the final mark is (2.20+1.81) = 4.01, or B.			

Table V. Predicting final marks in drafting from scores on Minnesota paper FB and Crawford spatial relations test

Table VI gives the facilitating data for all three tests together, weighted as indicated by regression equation 5 in Table III. Simply transmute the obtained test scores into their weighted values, and add these values:

Estimated Final Mark

$$X_1 = W_2 + W_3 + W_4$$

In any case where there is great disparity between scores so that the estimates from Table IV are at wide variance, careful consideration of the probable difficulty might be in order. Tables V and VI function best when their component scores do not indicate widely dissimilar ratings of the basic aptitudes which they measure. However, the estimate of X_1 from the regression equation will always be the best prediction possible from the available data.

Summary

The three tests discussed here were calibrated on a post-high school group which had had no further formal education. The regression equations and facilitating data in this report were based on the ND-800 course at Carnegie Institute of Technology in machine detail and design drafting. However, these tables may be applied with little inaccuracy to other industrial and school situations where prediction of mechanical drafting aptitude is desired. If the personnel selection problem is a truly industrial function, then a sharp screening process may be set up on the basis of tests.

However, if the problem lies in the educational area, then in all fairness these tests should rather be used as a basis for advantageous sectioning rather than exclusion. This difference derives from the different philosophies underlying personnel selection in industry and in education.

(a) Weighted Values for Minnesota Paper Form Board Scores:

Test Score	W_2	Test Score	W_2	Test Score	W_2
64	2.84	48	1.88	32	.92
62	2.72	46	1.76	30	.80
60	2.60	44	1.64	28	.68
58	2.48	42	1.52	26	.56
56	2.36	40	1.40	24	.44
54	2.24	38	1.28	22	.32
52	2.12	36	1.16	20	.20
50	2.00	34	1.04	18	.08

(b) Weighted Values for Crawford Spatial Relations Test Score:

Test Score	W_3	Test Score	W_3	Test Score	W_3
8.00	1.56	6.00	1.08	4.00	.60
7.75	1.50	5.75	1.02	3.75	.54
7.50	1.44	5.50	.96	3.50	.48
7.25	1.38	5.25	.90	3.25	.42
7.00	1.32	5.00	.84	3.00	.36
6.75	1.26	4.75	.78	2.75	.30
6.50	1.20	4.50	.72	2.50	.24
6.25	1.14	4.25	.66	2.25	.18

(c) Weighted Values for Crawford-Bennett Point-Motion Test Scores:

Test Score	W_4	Test Score	W_4	Test Score	W_4
21	1.68	14	1.12	7	.56
20	1.60	13	1.04	6	.48
19	1.52	12	.96	5	.40
18	1.44	11	.88	4	.32
17	1.36	10	.80	3	.24
16	1.28	9	.72	2	.16
15	1.20	8	.64	1	.08

Example: For scores of 50 on the Minnesota Paper FB, 6.50 on the Crawford Spatial Relations Test and 12 on the C-B Point-Motion Test, the best estimate of the final mark is (2.00 + 1.20 + .96) = 4.16 or B.

Table VI. Predicting final marks in drafting from scores on Minnesota paper FB, Crawford spatial relations test and Crawford-Bennett point-motion test

The following scheme of administration of these three tests is advantageous when the group to be tested is large. First, administer the Minnesota Paper Form Board to all the group; this test requires twenty minutes. Immediately score this test by having each applicant bring his test folder through a "scoring aisle" where several scorers are seated at tables, ready to check the tests. A Minnesota test can be accurately scored in one minute. The extremely poor cases may be differentiated at this point, if that is desirable.

Behind screens or in another room, the applicants are then individually given the Crawford Spatial Relations Test, and the total for these two tests used to estimate the final mark from Table V. Upon this value the desired differentiations may be made, especially if other factors in the general high school career such as grades in mathematics have been listed plainly on the applicant's card. The Crawford test averages about five minutes per person to give and score.

Later, the Point-Motion Test (special form A) may be administered to class groups, and another estimate of achievement made from Table VI data. This test will require about thirty minutes.

The cost of materials for testing a hundred persons with the whole battery will probably be less than $25. The Minnesota forms are used up in the process, but the Crawford Spatial and Point-Motion Tests may be reused many times. The battery is inexpensive and requires a very short time to administer and score. These tests may be purchased by qualified persons from the Psychological Corporation, 522 Fifth Avenue, New York. At present, work is proceeding on a less difficult form of the Point-Motion test, but the existing form A is suitable for use in the battery described here, when administered above the eleventh grade.

The manifold advantages accruing from the use of such calibrated aptitude test batteries as here illustrated are paramount in these days. Fewer failures, less discouragement, and greater over-all efficiency are virtues in any school or in all industry.

Bibliography

1. Badger, Alex J., *Standard Tests in the Fundamentals of Mechanical Drawing*, Bloomington, Ill., Public School Publishing Co. (1929).
2. Castle, Drew W., *Mechanical Drawing Tests*, Peoria, Ill., Manual Arts Press (1927).
3. ——— "Mechanical Drawing Tests," *Vocational Education Magazine*, Vol. 2, pp. 756–8, May, 1924.
4. Christy, Elmer W., *Mechanical Drawing Scale*, Peoria, Ill., Manual Arts Press (1926).
5. Fischer, Ferdinand A. P., *Mechanical Drawing Tests*, Milwaukee, Wis., Bruce Publishing Co. (1930).
6. Flam, August, "First Year Mechanical Drawing Tests," *Industrial Arts Magazine*, Vol. 17, pp. 223–336, June and September, 1928.
7. ——— "Second Year Mechanical Drawing Test," *Industrial Arts Magazine*, Vol. 17, p. 371, October, 1928.
8. ——— "Some Mechanical Drawing Tests," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION MAGAZINE, Vol. 19, p. 150, April, 1930.
9. Kroll, Harry W., "A Mechanical Drawing Test," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION MAGAZINE, Vol. 20, pp. 127–9, April, 1931.
10. Horning, S. D., "Tests of Prognostic Value in Mechanical Drawing," *Industrial Education Magazine*, Vol. 29, pp. 441–444, June, 1928, and Vol. 30, pp. 141–147, April, 1931.
11. Stoy, E. G., "Tests for Mechanical Drawing Aptitude," *Personnel Journal*, August, pp. 93–101, 1927.
12. French, T. E., *Engineering Drawing*, New York, McGraw-Hill Book Company (1936).
13. French, T. E., and McCully, H. M., *Engineering Drawing Sheets* (Series C). New York, McGraw-Hill Book Company (1936).
14. Crawford, John E., and Dorothea M., "A New Test for Tridimensional Structural Visualization," *J. of Applied Psychology*, Aug., 1940.

——— "Measurement of Some Factors upon Which is Based Achievement in Machine Detail Drafting," doctoral dissertation, University of Pittsburgh, 1941.

Methods of Testing in Mechanical Drawing

STANLEY S. RADFORD*

Teachers and supervisors of mechanical-drawing courses are interested in the results of teaching effort. Is the effort of the teacher successful in imparting a knowledge of the fundamentals of drawing as well as developing the best technique possible with a given age group? An adequate testing program set up so that a variety of tests are given at intervals during the term or semester is a valuable aid in determining whether fundamentals of the course are being absorbed by the students. Such a testing program should be considered as a tool for checking on the results of teaching to discover weaknesses in student work and permit remedial work being done from time to time as the course progresses. At present the tests most frequently used in mechanical drawing are those quite generally used in educational practice, namely, the essay-type or written test, true-and-false test, completion test, the multiple-choice test, and the project or problem test.

It is the writer's observation that there is a wide variation in the type of tests being used and the manner of giving tests in various school systems. Tests are selected and given by the teacher or supervisor depending upon personal liking or choice of one type of test as being superior or better than another. Some prefer giving short tests at frequent intervals during the course and omitting a final examination. Others prefer omitting short tests during the course and the giving of a long final examination at the end of the course. There are others that follow the practice of giving short tests during the course and a comprehensive final examination at the end of the course. Some confine the testing program entirely to the use of the essay type

*Michigan State College of Agriculture and Applied Science, East Lansing, Mich.

of test in the variety of procedures suggested above. Others have discarded the essay type of test in favor of using one or several tests such as the true-and-false test, completion test, or the multiple-choice test. Others use a battery of tests consisting of both essay and the other types of tests, which are given at convenient intervals during the course and may or may not be followed by a comprehensive final examination at the end of the course. Another type of test is often given by drawing or drawing practice. In this case the instructor in grading such a question should allow credit if the statement as worded by the student is a true statement in the sense as used in shop and drawing practice, rather than marking it wrong because the exact word used in text or course as presented is not used. Statements not answered or partially answered are usually marked wrong in grading tests of this kind. Care must be taken in giving this kind of a test not to include statements which have not been covered in regular classroom work previously. Due to the impossibility of setting up a completion test to fit the wide variety of teaching conditions, the completion test on page 247 of the June, 1941, issue of this magazine, may be used in devising a test to fit a given situation. It is not expected that this test can be used equally well in all situations, which vary widely, but that it can be readily adapted by the individual instructor in building up a testing program to suit a particular course of study, student age group, etc. However, this test in its entirety can be given to students about to graduate from a trade or technical high school with an expectancy of reasonable success on the part of the students, as it covers subject matter usually given in foundation courses in mechanical drawing in these schools. Sufficient time should be allowed in giving the test so as not to hurry the students. When three fourths of the students taking the test have finished it, the instructor may grant an additional time limit of 10 minutes, then pick up the papers at the end of this period finished or unfinished as the case may be. In this manner, the instructor as he gives a test of this kind from time to time, can arrive at a fair time allotment for the test and require that all papers be turned in at the end of the time allotted regardless of whether all are finished or not.

The Multiple-Choice Test

This type of test is preferred by many in that a number of words are given and the student is asked to underscore the word which makes the statement correct. This test requires that the student make a correct choice of one word out of several given, it being possible to use only one correctly, since use of any of the other words makes the statement incorrect or partially wrong. There is only one possible correct answer to be made by the student in answering each statement, so this test can be graded quickly and objectively. It requires a technical knowledge of the course content and enables a comprehensive examination being made. Most teachers do not use these tests as much as other tests because multiple-choice tests are more difficult to set up, to make statements in such a manner as to give a choice of words so that the correct word to use will not be too obvious to the student taking the test.

The Project or Problem Test

This form of test is used quite frequently by drawing teachers as a practical method of testing not only the student's knowledge but his technique and speed of layout as well. It consists of a carefully selected project or problem which brings out as much practical knowledge as possible, testing the student's knowledge as to projection, dimensioning, the giving of notes in a correct manner, accuracy of layout, lettering, neatness, speed of work, etc. The project selected should be similar to those given previously during the course and preferably should be given toward the close of the course so that sufficient time is allowed for correction, grading, and discussion of results with students. The average student drawing time should be determined as accurately as possible, previous to giving the project as a test problem. At the end of the time allotted, all test problems are turned in regardless of the degree of completion. Tests of this kind are very enlightening and worthwhile, but are often difficult to grade objectively. A good way to grade such a test problem is to set up a point basis and follow it as a guide in grading as uniformly as possible. A sample form is submitted below for use in this manner.

TECHNIQUE GRADE

FREEHAND SKETCH
MECHANICAL DRAWING
TRACING

NO.	POINT BASIS	PERFECT	ACTUAL
1	LAYOUT	15	
2	LINEWORK (*Projection*)	25	
3	DIMENSIONING	25	
4	LETTERING	10	
5	NEATNESS	10	
6	TIME	15	
	TOTAL POINTS EARNED	100	

Conclusions

In summary, the following conclusions may be drawn:

1. All the kinds of tests discussed require a knowledge of subject matter by the student in order to write them successfully, but each test requires different abilities on the part of the student due to its form of presentation.

2. Since all of these tests are being used in one form or another by drawing teachers in most trade and technical high schools, it is well to expose all types of students to a variety of tests, making use of all the tests so that students become familiar with writing each kind.

3. It would seem desirable to set up a battery of tests, one of each kind to be given at convenient intervals during the course of courses in drawing, with time allotted for discussion of the results of such tests with the students. An average of grades made on these tests can be made quickly to determine a test average at the end of any course which in turn can be easily averaged with regular classroom or project grades to determine a final grade for the course.

4. It is only as the instructor uses all types of tests, gains experience in their use, that all the inherent values of each kind of test become more apparent. As students take these tests and become more experienced in answering or writing each kind, a more comprehensive grasp of subject matter is attained and many misconceptions are revealed and corrected.

5. All forms of testing discussed have their place and will continue to be used as methods of determining the results of teaching effort. A thorough testing program is essential and desirable for the purpose of bringing about a more thorough mastery of trade or technical knowledge by the student.

A PERFORMANCE TEST INVOLVING ACCURACY, FINISH, AND TIME

Robert S. Hunter
Wilkinsburg, Pa.

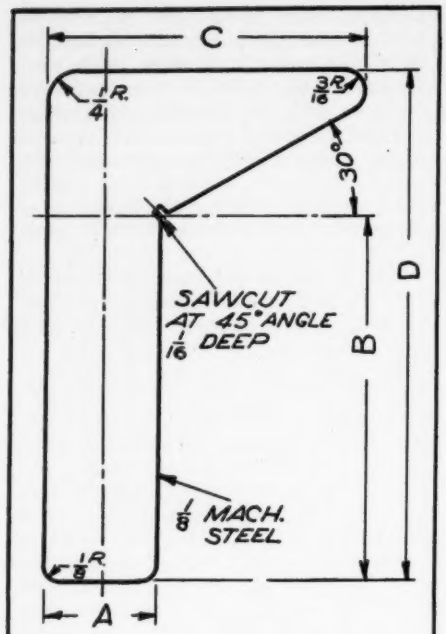
The following method of testing attempted to include the time taken to complete a job, the accuracy of the job, and the finish of the job. The result of the test, therefore, should be a measure of pupil efficiency in all three elements.

The vocational shop teacher is usually not greatly concerned with the pupil's speed on the job, but is more concerned with the teaching of fundamental skills. But in training boys for jobs in industry the factor of speed should not be overlooked lest the boy, upon entering industrial employment, find himself at a disadvantage. It seems to be desirable, therefore, to devise a test that will combine all three elements, speed, accuracy, and finish, and by so doing measure pupil efficiency.

The test job shown in Figure 1 is similar to a project given to the first-year boys in machine-shop practice. It is a bench job, and involves chipping, or hack sawing, layout, filing to a line, measuring with a micrometer, filing and fitting to radius gauges, and draw-filing for finish.

The accuracy of the piece was measured with a micrometer caliper and points were given for each micrometer measurement taken. If the measurement was exact, the pupil received 50 points. If the measurement was off .001 in., he received 40 points; if the measurement was off .002 in., he received 30 points, etc. No credit was given for a micrometer measurement if it was off more than .004 in. Likewise, the pupil received 25 points for each scalar measurement taken to an accuracy of plus or minus 1/64 in. Each radius, when checked with a radius gauge, could net the pupil a maximum of 25 points.

Each pupil's time was recorded separately. The time consumed waiting for the use of a particular tool was not included as part of the time taken to complete the job. Con-



ITEM	A	B	C	D
1	3/4	2	1 3/4	2 7/8
2	.750	2.000	1.750	2.875

TOLERANCE FOR ITEM 1 IS TO BE ±1/64.

TOLERANCE FOR ITEM 2 IS TO BE ±.002.

Fig. 1. Drill gauge

sequently, the time on the job was each pupil's actual working time.

A study of the test data reveals the fact that when the time column 6 is compared with column 7, the time taken to complete the job is considered (see columns 6 and 7), 47.4 per cent of the pupils achieved a higher grade, that 36.8 per cent of the pupils received a lower grade, and that 15.8 per cent of the pupils received the same grade. It is likewise of interest to note that when the time taken to complete the job is considered the per cent of failing grades increased approximately 5 per cent. It appears that this testing device eliminates more of the manifestly unfit.

The advantages of this testing device, therefore, may be listed as follows:

1. The slow but accurate pupil is not jeopardized.
2. It tends to eliminate the slow and inaccurate worker.
3. It puts pupils to work under pressure and so tends to simulate industrial conditions.
4. It tends to make the pupil more conscious of speed in accomplishing the job.
5. Test results tend to follow the curve of normal distribution.
6. It is almost wholly an objective method of testing except for the more or less subjective method of judging the finish or quality of the job.
7. A scarcity of shop tools need not prevent the use of this testing device.
8. It prevents possible teacher discrimination.

TEST DATA

	Columns 1	2	3	4	5	6	7
	P			S_q	E		
Pupil	Points for accuracy and finish	Working time on job hours	Average time on job hours	Per cent time increase or decrease of average time on job	Accuracy and finish points corrected for speed	Grade by standard deviation formulae based upon column 5	Grade by standard deviation formulae for accuracy and finish only. Column 1
1	185	2.02	3.24	+37.6	255	A } 10.5%	B
2	200	2.47	3.24	+23.8	248	A }	B
3	155	2.10	3.24	+35.2	209	B } 21.0%	C
4	155	2.15	3.24	+33.8	207	B }	C
5	150	2.12	3.24	+34.6	202	B }	C
6	165	2.73	3.24	+15.7	191	B }	C
7	225	4.00	3.24	-23.4	171	C } 36.9%	A
8	190	3.57	3.24	-10.1	171	C }	B
9	175	3.40	3.24	- 4.9	166	C }	B
10	125	2.33	3.24	+28.0	160	C }	D
11	125	2.82	3.24	+13.0	141	C }	D
12	130	3.23	3.24	+ 0.3	130	C }	C
13	105	2.57	3.24	+20.6	129	C }	D
14	135	3.83	3.24	-18.1	112	D } 15.8%	C
15	135	3.97	3.24	-22.4	105	D }	C
16	140	4.55	3.24	-40.2	84	D }	C
17	85	4.38	3.24	-35.2	55	F } 15.8%	F
18	95	4.65	3.24	-43.4	54	F }	D
19	83	4.87	3.24	-50.9	41	F }	F

Formula: $E = P \pm PS_q$

where E = pupil efficiency as measured by accuracy, speed, and finish for a job.

where P = total points for accuracy and for finish.

where S_q = speed quotient. The speed quotient may be defined as the per cent increase or decrease of the average time taken for the test job. It is the ratio of

$$\frac{\text{the average time on the job - the working time}}{\text{average time}}$$

or

$$\frac{\text{the working time on the job - the average time}}{\text{average time}}$$

When the average time is greater than the working time the speed quotient is positive. But when the working time is greater than the average time the speed quotient is negative.

Example 1

$E = P \pm PS_q$

$= 185 + (185 \times .376)$

$= 185 + 70$

$= 255$

$S_q = \frac{\text{the average time - the working time}}{\text{average time}}$

$= \frac{(3.24 - 2.02)100}{3.24} = \frac{1.22100}{3.24}$

$= 37.6\%$

9. The time allotted for completing the job is not arbitrarily fixed, but is based upon the average time taken to finish the job.

The disadvantages of this testing device may be listed as follows:

1. The use of this testing device requires two days or longer for completion.
2. Pupils' reaction to test situation (true of any test).

TEST FOR STUDENTS OF PRINTING

R. Randolph Karch

Principal, Printing High School
Cincinnati, Ohio

Writing and Publishing. Unit I Mastery Test

SECTION I

Questions are true or false, or multiple choice — one or more answers may be correct in the latter.

Return this test sheet with your answer sheet.

1. Morning newspapers outnumber evening newspapers.
2. There were over 1900 daily newspapers in the United States in 1938.
3. Weekly newspapers, in the United States, number: (*a*) 3337; (*b*) 4337; (*c*) 5337; (*d*) 6337; (*e*) 7337; (*f*) 8337.
4. A newspaper publisher is always the owner of the paper.
5. A newspaper publisher acts as a coordinator of the staff.
6. The editor, in general, has one of the following duties:
   a) Direct news and policy, contact public, control editorial department writers.
   b) Supervise those in charge of the reporters, handle news presentation.
   c) Take charge of gathering local news, determine news beats.
   d) Take charge of copy desk and direct make-up.
   e) Write and direct writing of editorial page and feature section.
7. The news editor, in general, has one of the duties described in question 6.
8. The associate editor, in general, has one of the duties described in question 6.
9. The city editor, in general, has one of the duties described in question 6.
10. The managing editor, in general, has one of the duties described in question 6.

11–15. Name five department editors. (Use spaces 11–15 on test sheets for answers.)

16. Chief of the mechanical foremen is the:

17–20. Foremen are usually in charge of these four departments: (Use spaces 17–20 for answers.)

21. Machine operators usually take care of their own machine difficulties on large dailies.
22. The man who assembles "takes" when set in type is called:
23. Operators receive their takes from the man called a:
24. The man in charge of wire news is usually called the:
25. Men who do leg work and have no regular news calls are:
   a) News service reporters.
   b) General assignment reporters.
   c) Special writers.
   d) Rewrite men.
   e) Bureau correspondents.
   f) Beat reporters.
   g) Staff correspondents.
   h) Department reporters.
   i) State correspondents.
26. Those who prepare stories phoned in are called: (See 25)
27. Those who call regularly at certain news sources are called: (See 25)
28. Those who cover such activities as sports, radio, movies, etc., are called: (See 25)
29. Those who cover news outside the city to provide news for one paper are called: (See 25)
30. Those permanently located in good news-source cities are called: (See 25)
31. Those who work on staffs of enlarged correspondent services are called: (See 25)
32. Those taking care of particular phases in the news, such as politics, art, etc., are called: (See 25)
33. Those who gather news for the wire services are called: (See 25)
34. The man in charge of paper distribution is called the:
35. The average hourly rate for typographical workers in principal cities of the United States, in 1938, was: (*a*) $1.126; (*b*) $1.404; (*c*) $.941; (*d*) $1.252; (*e*) $1.102; (*f*) $1.632.
36. The average rate, as shown in 35, for

pressmen is:
37. The average hourly rate, as shown in 35, for stereotypers is:
38. The average hourly rate, as shown in 35, for photoengravers, is:
39. The average hourly rate, as shown in 35, for mailers, is:
40. Stereotypers make curved plates only.
41. The slot man supervises work of the copy-reader.
42. The man who whips stories into shape, catches errors, eliminates the superfluous, and guards against libelous statements is called:
43. When complete, editors hand their stories to the:
44–45. Name two wire services — give initials.
46. There are more triweekly than semiweekly newspapers.
47. Weekly newspapers, if entered as second-class mail, may be sent for one cent per pound in one county.
48. Free circulation newspapers may be sent under second-class mail.
49. Hand-written manuscripts can be sent through the mails third- or fourth-class mail.
50. Proofs, with hand-written corrections, must be sent first-class mail.

SECTION II

51. The duties of magazine editorial workers are standardized.
52. One of the greatest difficulties in magazine publishing is in relations with printers.
53. Weekly magazines outnumber monthlies.
54. Magazines are often published at a loss for the *fun* of it.
55. The most important staff member of a magazine is the editor.
56. One of the main jobs of the editor is to:
    a) Discover and contact writers and authors.
    b) Handle business of the magazine.
    c) Work with the printer on production.
    d) Write book reviews.
    e) Interview and work with artists.
    f) Keep old subscribers and get new ones.
    g) Direct work of advertising salesmen.
57. One of the main duties of the advertising manager, according to 56, is to:
58. One of the main duties of the managing editor, according to 56, is to:
59. One of the main duties of the circulation manager, according to 56, is to:
60. One of the main duties of the literary editor, according to 56, is to:
61. One of the main duties of the business manager, according to 56, is to:
62. One of the main duties of the art editor, according to 56, is to:
63. Printers often advance credit to a magazine just starting, and lose it.

SECTION III

64. Book publishing is much like that of other publishing businesses, in regard to profits.
65. The publishing center is in and around Boston, Mass.
66. From 1875 to the present, only 40 books have sold over a million copies each.
67. The first novels of authors seldom sell over: (*a*) 500 copies; (*b*) 1000 copies; (*c*) 1500 copies; (*d*) 2000 copies; (*e*) 2500 copies; (*f*) 3000 copies.
68. The largest publisher in regard to number of titles in 1938 was: (*a*) McGraw-Hill; (*b*) Grosssett and Dunlap; (*c*) Dutton; (*d*) Macmillan; (*e*) Doubleday; (*f*) Scribner.
69. The year 1938 saw more publishers than the 10 years preceding 1938.
70. The total number of publishers operating in 1938 was: (*a*) 143; (*b*) 243; (*c*) 333; (*d*) 433; (*e*) 543.
71. The total number of titles published in 1938 was: (*a*) 6225; (*b*) 7225; (*c*) 8225; (*d*) 9225; (*e*) 10,225; (*f*) 11,225.
72. From 1922 to 1937 there was a steady rise in number of books published.
73. Publisher's profits on the average novel run, on each book, range from: (*a*) 3 to 6 cents; (*b*) 4 to 8 cents; (*c*) 5 to 10 cents; (*d*) 6 to 12 cents; (*e*) 8 to 15 cents.
74. The bookseller makes about $1 profit on a $2.50 book.
75. The manufacturing cost on 2500 copies of the average novel, selling for $2.50, is about: (*a*) 25 cents; (*b*) 50 cents; (*c*) 75 cents; (*d*) $1; (*e*) 65 cents; (*f*) 85 cents.
76. If the average novel sells out, the publisher's total profit averages about: (*a*) $50; (*b*) $75; (*c*) $100; (*d*) $125; (*e*) $150; (*f*) $175.
77. More money per book is made by the author and publisher on editions selling over the first printing.
78. Cheap reprints of popular works often sell over ten million copies in one year.
79. Publishers usually own the copyright on the author's works.
80. Publishers are held responsible for violation of copyright, not the authors.
81. Writers pay for alteration on original manuscript which amounts to from 5 to 15 per cent of the total composition cost.
82. Royalties increase in percentage as the book runs into more printings.
83. Authors make from 10 to 15 per cent on books sold.
84. Few assistants in one department can take over the duties of another in book publishing houses.

PRETEST FOR INDUSTRIAL-ARTS LABORATORY CLASSES

Raymond J. Coltharp
Rolla, Mo.

Every pupil enrolling in the ninth-grade industrial-arts course in the Burns Consolidated Schools is required to take this pretest. The findings of the pretest give the instructor a fairly definite idea as to the knowledge, experience, and background of the pupil as regards tools and materials. Thus the materials, jobs, assignments, projects, and related information can be better organized, and the course can contribute much to the pupils' cultural development, which, according to Goodykoontz[1] "is incomplete without concepts, understandings, and appreciations regarding manufacturing and its host of workers."

The items dealt with in the test are selected from the "Know and Do" units, as listed by the American Vocational Association Committee on Standards of Industrial Arts. The test is again given during the latter part of the year as a check upon the efficiency of the teaching, and thus serves both as a diagnosis and a final examination.

[1]Goodykoontz, Bess, *Industrial Arts, Its Interpretation in American Schools*, United States Department of Interior Office of Education, Bulletin No. 34, 1937.

Directions: You are asked to answer all questions to the best of your ability. Your score in this test will have no bearing upon any grades, marks, or rankings you may later receive in this course. Instead, your score will help your instructor to advise you in your industrial-arts work, just as the doctor examines the patient before he prescribes medicine. Please fill in the date and your name; in answering the true-false items in Parts I, III, V, VII, and IX, place a plus mark before each statement which is true, and a zero before each statement which is false; in answering the multiple-choice items in parts II, IV, VI, VIII, and X, before each statement place the number of the term in parentheses which makes a correct statement. Do not fill in the blank beside the word *Right*.

Woodwork

Part I. True-False

No. Right ....

.... 1. Black walnut is a hardwood.
.... 2. Varnish is transparent.
.... 3. A jack plane has two adjustments.
.... 4. A crosscut saw is used to saw with the grain.
.... 5. Shellac is thinned with alcohol.
.... 6. Oily rags should be kept in closed wooden containers.
.... 7. The rule should be laid flat when measuring.
.... 8. Chamfers are cut with a plane.
.... 9. Casein glue is waterproof.
.... 10. Common nails are set below the surface.
.... 11. A board is always longer than it is wide.
.... 12. Boards should be sandpapered with the grain.
.... 13. Lumber is sold by the square foot.
.... 14. Chisels should not be used for scraping.
.... 15. Hammer handles are made of hickory.
.... 16. The number 8 on the tang of an auger bit indicates that the bit is ½ in. in diameter.
.... 17. Wood is kiln dried by seasoning for several years.
.... 18. Basswood is a hardwood.

Part II. Multiple-Choice

No. Right ....

( ) 19. (1. Ash) (2. oak) (3. pine) is use in making ball bats.
( ) 20. Screws are sold by the (1. pound) (2. dozen) (3. box).
( ) 21. Paint is thinned with (1. alcohol) (2. linseed oil) (3. kerosine).
( ) 22. (1. No. 2) (2. No. 2/0) (3. No. 1) sandpaper is finest.
( ) 23. A (1. punch) (2. countersink) (3. brad awl) is used in making pilot holes for screws.
( ) 24. The (1. mallet) (2. claw hammer) (3. ball-peen hammer) should be used in striking on wood.
( ) 25. A jack plane is (1. 22 in.) (2. 14 in.) (3. 8 in.) in length.
( ) 26. Gumwood is frequently stained to resemble (1. walnut) (2. cedar) (3. oak).
( ) 27. (1. water) (2. alcohol) (3. linseed oil) is added to animal glue to dissolve it.
( ) 28. The (1. block) (2. jointer) (3. jack) plane is the shortest.
( ) 29. The age of a tree can be deter-

mined by counting the (1. knots) (2. annual rings) (3. medullary rays).

( ) 30. Dowels are usually made of (1. maple) (2. birch) (3. spruce).

Electricity
Part III. True-False

No. Right ....

.... 31. A compass points directly north in California.
.... 32. Water is a poor insulator.
.... 33. Amperes are used as heating elements in electric irons.
.... 34. Static electricity is used in buzzers.
.... 35. Lightning is a form of electricity.
.... 36. Heating a magnet decreases its strength.
.... 37. Electricity travels more quickly than does sound.
.... 38. Users of electricity pay for it by the volt.
.... 39. A washing-machine motor uses less electricity than a toaster.
.... 40. Brass can be magnetized.
.... 41. A closed circuit is necessary for electricity to flow.
.... 42. Transformers change direct current to alternating current.
.... 43. The voltage in most houses is 110.
.... 44. An electric meter has four dials.
.... 45. A small wire offers more resistance than a large wire.
.... 46. Indirect lighting is caused by transparent shades.
.... 47. Dry cells cannot be recharged.

Part IV. Multiple-Choice

No. Right ....

( ) 48. Rattail refers to a (1. splice) (2. cutting tool) (3. kind of tape).
( ) 49. Electricity flows through (1. conductors) (2. insulators) (3. magnets).
( ) 50. Wires used in house wiring are commonly made of (1. soft iron) (2. copper) (3. tungsten).
( ) 51. The (1. voltage) (2. age) (3. specific gravity) of a storage battery is tested with a hydrometer.
( ) 52. The flow of an electric current (1. heats) (2. cools) (3. does not affect the temperature of) the conductor.
( ) 53. Electricity flows because of (1. heat) (2. magnetism) (3. a difference in pressure).
( ) 54. Fuses serve as (1. safety devices) (2. transformers) (3. conductors).
( ) 55 A magnet has (1. two poles) (2. four poles) (3. one pole).
( ) 56. Friction (1. produces) (2. repels) (3. polarizes) electricity.
( ) 57. The electricity used in house lighting is produced by (1. dry cells) (2. generators) (3. electric furnaces).

Planning and Drawing
Part V. True-False

No. Right ....

.... 58. Vertical lettering strokes are made upward.
.... 59. Distances are transferred with the dividers.
.... 60. There are at least two views in all orthographic projections.
.... 61. In dimensioning a circle the radius should be given.
.... 62. A ruling pen is filled by being dipped in the bottle.
.... 63. A sketch is shaded by the use of artificial light.
.... 64. A line which is too light should be made heavier by retracing backwards.
.... 65. The T square is made of hardwood.
.... 66. The title of the drawing should be placed on the sheet before beginning the drawing.
.... 67. A bill of materials should always be filled out before beginning the drawing.
.... 68. Sketching is usually done freehand.
.... 69. An octagon is a square figure.
.... 70. In estimating material costs, 25 per cent should be added for waste.
.... 71. Mechanical drawing is known as a universal language.
.... 72. Capital letters are sometimes called upper-case letters.
.... 73. Drawing paper is usually thicker than ordinary paper.
.... 74. There are 180 deg. in all triangles.
.... 75. Tracing cloth is used in making carbon copies of drawings.
.... 76. A protractor is used in measuring the number of degrees in an angle.

Part VI. Multiple Choice

No. Right ....

( ) 77. A line consisting of a series of short dashes represents (1. an invisible edge) (2. the center of a circle) (3. a visible edge).
( ) 78. The dimensions of boards are given with the (1. thickness) (2. width) (3. length) first.
( ) 79. The (1. line) (2. circle) (3. dimension) is the foundation of mechanical drawing.
( ) 80. A (1. 6H) (2. H) (3. HB) pencil is the hardest.
( ) 81. Drawing boards are made of (1. hard) (2. soft) (3. heavy) wood.
( ) 82. Horizontal lines are drawn with (1. the upper) (2. the lower) (3. either) edge of the T square.
( ) 83. Notes and explanations are (1. written) (2. lettered) (3. stamped) on drawings.
( ) 84. There are (1. 14) (2. 20) (3. 24) board feet in two pieces of lumber 3 by 6 in. by 8 ft.
( ) 85. The bow pen is used in (1. lettering) (2. drawing small circles) (3. drawing guidelines).
( ) 86. Modernistic furniture originated during the (1. Renaissance) (2. Revolutionary War) (3. twentieth century).
( ) 87. The workman who draws the plans for buildings is called (1. architect) (2. contractor) (3. carpenter).

Ceramics
Part VII. True-False

No. Right ....

.... 88. One cubic foot of cement, two cubic feet of sand, and four cubic feet of aggregate will make seven cubic feet of concrete.
.... 89. A thin sloppy mixture of concrete is better than one which is jellylike.
.... 90. Bricks are sold by the pound.
.... 91. Plate glass is usually thicker than window glass.
.... 92. Recently developed plastics are as transparent as glass.
.... 93. Sand should be washed by pouring water on the sandpile.
.... 94. Window glass is cut with a hack saw.
.... 95. A sack of cement weighs appproximately 90 pounds.
.... 96. Bricks are made of sand and cement.
.... 97. Concrete is reinforced to make it heavier.
.... 98. Pottery is made of clay.
.... 99. The term "green concrete" means that the concrete has not set.
.... 100. Keene cement is a brand of cement used in constructing pavement.
.... 101. Pottery and dishes are glazed by being painted and varnished.
.... 102. Mortar used in laying bricks is purchased ready mixed.
.... 103. A striking board is used for tamping concrete in forms.
.... 104. A kiln is used to quicken the curing of concrete.

Part VIII. Multiple-Choice

No. Right ....

( ) 105. The hardening of concrete is (1. completed within 24 hours) (2. goes on for several weeks) (3. continues for years).
( ) 106. In laying brick walls the mortar joints are usually (1. ¼ in). (2. ½ in.) (3. 1 in.) thick.
( ) 107. (1. AA) (2. A) (3. B) glass is the best quality.
( ) 108. The plumb bob is used in (1. checking perpendicular walls) (2. cutting double strength glass) (3. mixing clay).
( ) 109. Glass is made chiefly of (1. sand) (2. clay) (3. carbon).
( ) 110. A mixture of 1:2:4 has (1. ½ as much) (2. the same quantity of) (3. four times as much) cement as sand.
( ) 111. Bricks are bonded together in walls by (1. breaking joints) (2. using fire clay) (3. mixing lime with mortar).
( ) 112. (1. Shatter-proof) (2. double-strength) (3. plate glass) is commonly used for windshields in the later models of cars.
( ) 113. If cinders are used as the aggregate in a concrete mixture, the concrete will be (1. porous) (2. waterproof) (3. unusually strong).

Metalwork
Part IX. True-False

No. Right ....

.... 114. An emery wheel should turn toward the material being ground.
.... 115. The scriber is used by the metalworker as a pencil.
.... 116. The center punch is used for punching rivet holes.
.... 117. Inside calipers are used for taking the diameters of shafts.
.... 118. A wire gauge is used to determine the diameter of wire.
.... 119. Twenty-four gauge iron is thicker than 28-gauge iron.
.... 120. When sawing with a hack saw, at least 50 strokes per minute should be made.

.... 121. A file card shows the kind of file to use.
.... 122. Rivets are made of cast iron.
.... 123. Twist drills are measured in eighths of an inch.
.... 124. Taps are used for cutting threads in holes.
.... 125. A wire edge refers to a tool used in cutting wire.
.... 126. Bolts are sold by the pound.
.... 127. Fifty-fifty solder is composed of one half lead and one half tin.
.... 128. Galvanized iron is treated to prevent rust.
.... 129. Case-hardening is a treatment for copper.
.... 130. Pewter can be soldered.

Part X. Multiple-Choice

No. Right ....

( ) 131. Peening refers to (1. polishing metal) (2. striking with a metalworker's hammer) (3. measuring).
( ) 132. Aluminum is (1. lighter than) (2. heavier than) (3. the same weight as) copper.
( ) 133. Tinplate consists of (1. thin sheets of tin) (2. sheet steel coated with tin) (3. sheet lead coated with tin).
( ) 134. (1. Bearings) (2. washers) (3. angle irons) are made of babbitt.
( ) 135. Cape refers to a (1. chisel) (2. funnel) (3. wrench).
( ) 136. Metalworker's rules are usually made of (1. bronze) (2. brass) (3. steel).
( ) 137. V blocks are used for (1. bracing right-angle corners) (2. holding rods while working on them) (3. measuring angles).
( ) 138. Carriage bolts have (1. round) (2. square) (3. hexagonal) heads.
( ) 139. An alloy is a (1. combination of two or more metals) (2. recently discovered metal) (3. process of hardening metals).
( ) 140. A template is a (1. part of the anvil) (2. pattern) (3. kind of chisel).
( ) 141. Stillson refers to a (1. pipe wrench) (2. punch) (3. laying-out tool).
( ) 142. An S trap is a part of a (1. drainage system) (2. wire cutter) (3. blowtorch).
( ) 143. (1. Zinc) (2. lead) (3. asbestos) is a good heat insulator.

Key to Pretest

Part I	22. 2	44. +	64. 0
1. +	23. 3	45. +	65. +
2. +	24. 1	46. 0	66. 0
3. +	25. 2	47. +	67. +
4. 0	26. 1		68. +
5. +	27. 1	**Part IV**	69. 0
6. 0	28. 1	48. 1	70. 0
7. 0	29. 2	49. 1	71. +
8. +	30. 2	50. 2	72. +
9. +		51. 3	73. +
10. 0	**Part III**	52. 1	74. +
11. 0	31. 0	53. 3	75. 0
12. +	32. +	54. 1	76. +
13. 0	33. 0	55. 1	
14. +	34. 0	56. 1	**Part VI**
15. +	35. +	57. 2	77. 1
16. +	36. +		78. 1
17. 0	37. +	**Part V**	79. 1
18. 0	38. 0	58. 0	80. 1
	39. +	59. +	81. 2
Part II	40. 0	60. +	82. 1
19. 1	41. +	61. 0	83. 2
20. 2	42. 0	62. 0	84. 3
21. 2	43. +	63. 0	85. 2
86. 3	100. 0	**Part IX**	129. 0
87. 1	101. 0	114. +	130. +
	102. 0	115. +	**Part X**
Part VII	103. 0	116. 0	131. 2
88. 0	104. 0	117. 0	132. 1
89. 0		118. +	133. 2
90. 0	**Part VIII**	119. +	134. 1
91. +	105. 2	120. 0	135. 1
92. +	106. 2	121. 0	136. 3
93. 0	107. 1	122. 0	137. 2
94. 0	108. 1	123. 0	138. 1
95. +	109. 1	124. +	139. 1
96. 0	110. 1	125. 0	140. 2
97. 0	111. 1	126. 0	141. 1
98. +	112. 1	127. +	142. 1
99. +	113. 1	128. +	143. 3

TOOL TEST—GENERAL METALWORK

G. L. Simnicht
High School
Elk River, Minn.

Directions: Place the name of the tool, or the correct name of the tool part, as directed in each question.

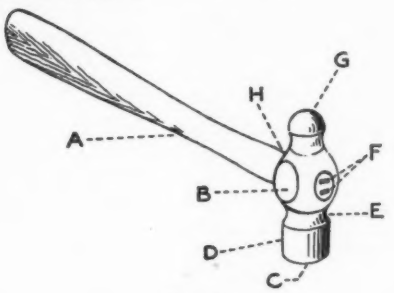


Fig. 1

1. The tool shown in Figure 1, is a ..... hammer.
2. *A* in Figure 1 is the .....
3. *B* is the .....
4. *C* is the .....
5. *D* is the .....
6. *E* is the .....
7. *F* is the .....
8. *G* is the .....
9. *H* is the .....

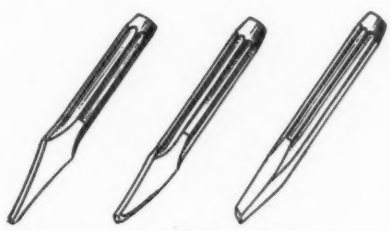


Fig. 2 Fig. 3 Fig. 4

10. In Figure 2 is shown a .....
11. Figure 3 shows a .....
12. Figure 4 is a .....
13. Figure 5 is an illustration of a .....
14. At *A* in Figure 5 is shown the .....
15. *B* is the .....

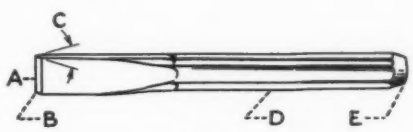


Fig. 5

16. *C* is the .....
17. *D* is the .....
18. *E* is the .....
19. The tool shown in Figure 6 is a .....
20. At *A* in Figure 6 is shown the ..... of the tool.

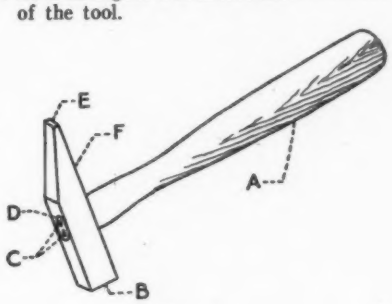


Fig. 6

21. *B* is the .....
22. *C* shows the .....
23. *D* is the .....
24. *E* is the .....
25. *F* is the .....

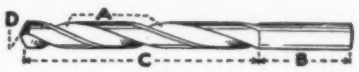


Fig. 7

26. The tool shown in Figure 7 is a .....
27. At *A*, in Figure 7 is shown the .....
28. At *B*, the .....
29. At *C*, the .....
30. At *D*, the .....

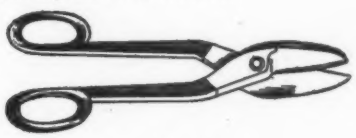


Fig. 8

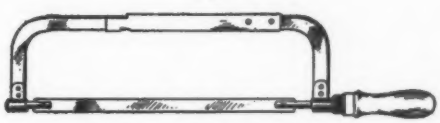


Fig. 9

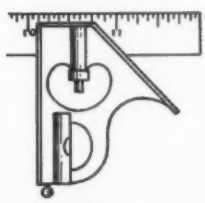


Fig. 10

Fig. 11

31. The tool shown in Figure 8 is a .....
32. The tool shown in Figure 9 is a .....
33. The tool shown in Figure 10 is a .....
34. The tool shown in Figure 11 is a .....

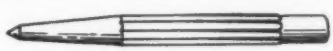


Fig. 12

35. The tool shown in Figure 12 is a .....

The perfect score is 35. Your score is .....

Key

1. ball-peen
2. handle
3. cheek
4. face
5. poll
6. neck
7. wedges
8. peen
9. eye
10. cape
11. round nose
12. diamond point
13. flat chisel
14. cutting edge
15. bevel
16. angle
17. stock
18. head
19. setting hammer
20. handle
21. face
22. wedges
23. eye
24. peen
25. head
26. twist drill
27. flute
28. shank
29. body
30. lips
31. tin snip
32. hack saw
33. combination square
34. end wrench
35. center punch

MECHANICAL-DRAWING TEST

W. G. Hjertstedt
Lane Technical High School
Chicago, Ill.

True-False Exercise

Specific Directions: Some of the following statements are true, and some are false. Read each statement carefully. Encircle the letter *T* if you think the statement is true. Encircle the letter *F* if you think the statement is false. If you do not think you know, ***do not guess.***

1. T F The pencil should be held about an inch from the point and inclined slightly in the direction in which the line is being drawn.
2. T F The size of an angle is not determined by the amount of opening between the two lines which form the angle.
3. T F The compass and the dividers should rest upon the mechanical-drawing paper of their own weight and should be manipulated from the head with the thumb and the first two fingers.
4. T F The study of mechanical drawing tends to develop in the student the love for systematic, precise, and neat work which will always add to the desirability of his services in any capacity.
5. T F The longest line drawn through the center of an ellipse is called the minor axis.
6. T F The complete title is near the front of a book.
7. T F The modern civil engineer does not make the preliminary surveys or prepare maps, specifications, contracts, or estimate cost. Neither does he make up reports for a wide variety of projects.
8. T F So wide are the applications of power today that engineering has become a profession of highly specialized pursuits.
9. T F Lettering is not a very important part of mechanical drawing.
10. T F Drawing pencils are graded by letters, from 6B (very soft and black) to 9H (extremely hard).
11. T F The modern civil engineer prepares detailed drawings, inspects and superintends construction, and in many cases operates the products of his work.
12. T F It is not the problem of a draftsman to represent solid objects on a sheet of mechanical-drawing paper in such a manner as to tell the exact shape.
13. T F The engineers are not dependent upon mechanical drawing and the draftsman for the wonderful progress they have made and are making.
14. T F Curved surfaces do not show as curves in all views.
15. T F A left-side view never describes an object as clearly as the right-side view.
16. T F Horizontal lines should not be drawn with a T square as a guide.
17. T F The Middle Ages saw the rise of a new form of engineering in the building of the great cathedrals of Europe.
18. T F Although during the last half of the nineteenth century wonderful industrial improvement developed, this period did not bring with it an increased demand for draftsmen and the necessity for specialization.
19. T F Mechanical drawing as a subject is rich in educational values.
20. T F The top view shows the height of a rectangular block.

Key

True 1, 3, 4, 6, 8, 10, 11, 14, 17, 19
False 2, 5, 7, 9, 12, 13, 15, 16, 18, 20

WOODWORKING TEST—COMPLETION QUESTIONS

Fred W. Weyer
Los Angeles, Calif.

Questions based on Hjorth's *Principles of Woodworking*

The correct word or words are to be inserted in the space provided for same.

1. To give strength, a dowel should be chosen that is ..... the thickness of the stock.
2. Dowels should be ..... before using to permit excess glue to escape.
3. The joint at the center intersection of a diagonal or cross brace is called a .... joint.
4. The ..... joint is the most important joint used in cabinet construction.
5. The face of a tenon is called the .....
6. The parts of a dovetail joint are called ..... and .....
7. Dovetail joints are used for ..... and ..... construction.
8. The groove in a dovetailed drawer front should be cut in the ..... because they are larger.
9. The panel put in the drawer rails that supports the drawer is used to ....
10. The reinforcing that is used in a picture-frame miter joint and set in a groove is called a ....
11. ..... glue is a stainless glue used in woodworking.
12. Animal glue is made ready for heating by ....
13. Hot glue is heated in a ....
14. The ..... marks on pieces to be glued should be matched when gluing up to insure a good job.
15. In cold weather pieces to be glued are ..... so that the glue will not become chilled.
16. Testing for accuracy on glue-up work is done with a ..... and a .....
17. Glue should be applied ..... to two boards by placing them ....
18. Bar clamps are held in position for gluing with ....
19. Clamps are shifted ..... on a frame to correct it for .....
20. Cabinetwork is protected against being marred by clamps in gluing, with ....
21. The inside surfaces of a drawer are finished and sanded ..... gluing up.
22. A drawer bottom is inserted in the grooves ..... gluing up the sides, back, and front.
23. Dowels are ..... and ..... so that they will enter the hole easier and so that the excess glue can escape.
24. .....is used on wood screws to allow them to enter more easily.
25. The most common hinge used in cabinetwork is the ..... hinge.
26. The position of hinges on a door and frame are marked ..... time.
27. Cylinder locks are usually used on .....
28. A table catch is used on ..... tables.
29. Cabinet door pulls are placed ..... horizontal center of the door.
30. Vibration in a turning lathe is caused by ..... and .....
31. The centers of a piece of square or rectangular wood to be turned are found by marking ..... lines.
32. Obtaining the depth of a cut on the lathe is done with the ..... tool and .....
33. Stock is roughed off and made cylindrical on the lathe with the .....
34. Smoothing a turned cylinder is done with the ..... chisel by ..... or .....
35. Circles are marked on a disk with the ..... working from the center.
36. A chuck for faceplate turning on the lathe is made of ..... by the turner.
37. The four most common ways of enriching and decorating wood are: 1. .....; 2. .....; 3. .....; 4. .....
38. Inlaying should be done on ..... woods.
39. Moldings made of fine-grain woods should be ..... in size; those of coarse-grained woods should be .....
40. Fluting and reeding are used to decorate a .....
41. Spiral turning is of ..... origin.
42. The type of carved ornament to be used should be in keeping with the ..... to which the furniture belongs.
43. The beginner in wood carving needs only a few tools, such as: 1. .....; 2. .....; 3. .....; 4. .....
44. A "scratch stock" is used by the wood carver to cut: 1. .....; 2. .....
45. Simple carved borders may be executed by using the ..... and .....
46. The background on carvings can be cut away with a machine tool called a .....
47. A beaded molding is sometimes called an .....
48. A veneer saw can be made by filing ..... on the edge of a .....
49. The monotony of a surface may be relieved by applying ..... or by .....
50. Varnish may be thinned with .....

Key

1. ⅛ to ½
2. grooved
3. cross lap
4. mortise-and-tenon
5. cheek
6. tails; pins
7. drawer; box
8. tails
9. exclude dust
10. slip feather
11. animal
12. soaking in water overnight

13. double boiler
14. face
15. heated
16. square; rule
17. simultaneously; face to face
18. slotted blocks of wood
19. diagonally, squareness
20. blocks and strips of wood
21. before
22. after
23. pointed; grooved
24. soap
25. loose pin butt
26. at the same
27. office furniture
28. tilt-top
29. above
30. high speed; irregular material
31. diagonal
32. parting; calipers
33. gouge
34. skew; scraping; cutting
35. dividers
36. wood
37. inlaying; veneering; carving; painting
38. close-grained
39. small; larger
40. column shaft
41. eastern
42. period
43. ½ in. skew chisel; 2 or 3 straight gouges; veining tool; a parting or V tool
44. beads; chamfers
45. V tool; gouge
46. router
47. astragal molding
48. teeth; knife
49. overlays; veining
50. turpentine

TOOL TEST — WOODWORKING

G. L. Simnicht
High School
Elk River, Minn.

Directions: Place the name of the tool, or the correct name of the tool part, as directed in each question.

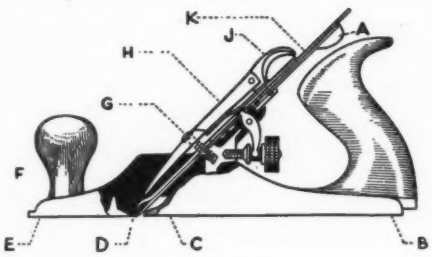


Fig. 1

1. The tool shown in Figure 1 is a .....
2. At *A* in Figure 1 is shown the .....
3. *B* is the .....
4. *C* is the .....
5. *D* is the .....
6. *E* is the .....
7. *F* is the .....
8. *G* is the .....
9. *H* is the .....
10. *J* is the .....
11. *K* is the .....

Fig. 2

12. The tool shown in Figure 2 is an .....
13. At *A* in Figure 2, is shown the .....
14. At *B*, the .....
15. At *C*, the .....
16. At *D*, the .....
17. At *E*, the .....

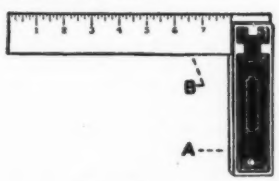


Fig. 3

18. The tool shown in Figure 3 is a .....
19. *A* in Figure 3 is the .....
20. *B* is the .....

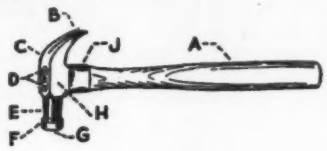


Fig. 4

21. The tool shown in Figure 4 is a .....
22. *A* in Figure 4 is the .....
23. *B* is the .....
24. *C* is the .....
25. *D* is the .....
26. *E* is the .....
27. *F* is the .....
28. *G* is the .....
29. *H* is the .....
30. *J* is the .....

Fig. 5

31. The tool shown in Figure 5 is a .....
32. *A* in Figure 5 is the .....
33. *B* is the .....
34. *C* is the .....
35. *D* is the .....
36. *E* is the .....

Fig. 6

37. The tool shown in Figure 6 is a .....
38. *A* in Figure 6 is the .....
39. *B* is the .....
40. *C* is the .....
41. *D* is the .....
42. *E* is the .....
43. *F* is the .....

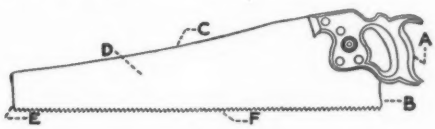


Fig. 7

44. The tool shown in Figure 7 is a .....
45. *A* in Figure 7 is the .....
46. *B* is the .....
47. *C* is the .....
48. *D* is the .....
49. *E* is the .....
50. *F* is the .....

The perfect score is 50. Your score is .....

Key

1. smoothing plane
2. lateral adjusting lever
3. heel
4. sole
5. throat
6. toe
7. knob
8. lever cap screw
9. lever cap
10. cam
11. plane iron
12. auger bit
13. tang
14. shank
15. twist
16. nibs
17. screw
18. try square
19. handle
20. blade
21. claw hammer
22. handle
23. claw
24. head
25. wedges
26. neck
27. poll
28. face
29. cheek
30. eye
31. screw driver
32. head
33. handle
34. ferrule
35. blade
36. tip
37. wood chisel
38. head
39. handle
40. blade
41. cutting edge
42. shoulder
43. ferrule
44. handsaw
45. handle
46. heel
47. back
48. blade
49. toe
50. teeth

WOODWORKING TEST

Louis Barocci
High School
Cudahy, Wis.

True-False Test

Directions: Place a circle around the letter *T* if the statement is true. Place a circle around the letter *F* if the statement is false.

1. T F The most common unit of measuring lumber is the board foot.
2. T F A board foot is 1 in. thick, 12 in. wide, and 1 ft. in length, or its equivalent.
3. T F A square foot of lumber is a piece 12 in. wide and 1 ft. long or its equivalent, regardless of its thickness.
4. T F Plywood, veneer, and siding are usually sold by the square foot.
5. T F The formula for figuring board feet is W times L, when the width and length are both expressed in feet.
6. T F A linear foot is 1 ft. in length, regardless of thickness or width.
7. T F Millwork, such as molding, quarter rounds, casings, jambs, stops, and the like, are sold by the linear foot.
8. T F Shingles are sold by the square, which is an area 10 ft. square — that is, 100 sq. ft.
9. T F Lumber surfaced on two sides is indicated thus: S4S.
10. T F To ease an arris means to slightly round it.
11. T F *FAS* designates the highest grades of hardwood lumber.
12. T F A check is a lengthwise separation of the wood, the greater part of which occurs across the growth rings.
13. T F Kiln drying is the removal of moisture through a controlled system of evaporation, utilizing heat, humidity, and air circulation.
14. T F Air-dried lumber is better adapted for furniture making than kiln-dried lumber.
15. T F The size of the teeth determines a crosscut or a ripsaw.
16. T F Poplar is an open-grained wood.
17. T F Oak is an open-grained wood.
18. T F Maple is a close-grained wood.
19. T F The core in plywood has its grain running in the same direction as the grain in the face of the plywood.
20. T F Plywood is purchased by the linear foot.
21. T F ¼-in. plywood is usually 3 ply.
22. T F Casein glue is a milk product.
23. T F Casein glue is not water resistant.
24. T F The best animal glue is made from beef hides.

25. T F The World War stimulated the use of casein glue.
26. T F Hard glue does not dull the knives of woodworking machines when the glued joints are surfaced.
27. T F Casein glue has a tendency to stain some woods.
28. T F Microorganisms cause a deterioration in animal glue and thus weakens its holding power.
29. T F It is not a good policy to preheat the wood before glueing.
30. T F Fish glue is a good furniture glue.
31. T F *Horseplay* is conductive to shop accidents.
32. T F Machines should not be used for trivial operations. Hand tools should be used instead.
33. T F Cylindrical work can be cut easily and safely on the band saw.
34. T F Stock less than 10 in. can safely be run over the jointer.
35. T F End grain should not be run over the jointer.

Completion Test

Directions: Fill in the blank spaces with the correct answer.

36. Lumber is measured by three methods; they are 1. ....., 2. ....., 3. .....
37. A formula for figuring board feet is as follows .....
38. The formula for figuring square feet is as follows .....
39. One thousand feet of lumber is expressed by the symbol .....
40. Lumber surfaced on two sides is indicated by the symbol .....
41. The standard loss due to surfacing a piece of rough lumber is about ..... or ..... inches.
42. The highest grades of hardwood lumber is designated as .....
43. Bark or lack of wood on the edge or corner of a piece of lumber is designated as .....
44. The highest grade of white pine is designated as .....
45. 250 feet of pine at $100 an M will cost .....
46. The Historic date of Chippendale furniture is about .....
47. Nails are sold by the .....
48. Shellac is cut with .....
49. When doing circular-saw work, don't allow the saw to project more than ..... above the stock to be cut.
50. Lumber surfaced on four sides is designated by .....
51. When you wish to purchase a panel which has only one good side, you designate that by the mark .....

FINAL MECHANICAL-DRAWING TEST

W. H. Bowers

High School
Tuckahoe, N. Y.

Developments

Directions: Read each statement carefully. If statement is correct place "T" before it; if statement is incorrect, place "F" before it. No erasing allowed.

Ask any necessary questions before you begin to write.

1. A pattern consists of the top and front view only.
2. There are two general classes of surfaces, plane and curved.
3. The cube is an object with a plane surface.
4. The true length of the edges are the same in all types of problems.
5. A cylinder and a prism have curved surfaces.
6. When the surface of a cylinder is enrolled it becomes a rectangle.
7. The length of the rectangle enrolled is equal to the diameter of the circle.
8. The length of the rectangle obtained by enrolling the cylinder may be obtained in two ways.
9. In sheet-metal drafting all solids are divided into four classes.
10. A parallel and an irregular form are considered in the same category.
11. Flaring work is the name given to patterns for regular tapering forms.
12. A plan is a view obtained by looking down upon the object.
13. An elevation is a view of the object in an upright position.
14. A stretch-out line is the line showing the distance around the pattern.
15. Heavy solid lines are used for laps.
16. The pattern is shown by means of thin dotted lines.
17. All construction lines are shown by using light colored lines.
18. Patterns not accurately made are usable in the shop.
19. A No. 1 soft pencil is desirable in sheet-metal drafting.
20. All views must be drawn full size.
21. It is permissible to draw one half of the pattern, if the drawing paper is too small.
22. Flaring forms are based on the regular pyramid.
23. In parallel forms the stretch-out is a curved line.
24. In flaring work the stretch-out is an arc.
25. A cone is considered a pyramid with many sides.
26. The pattern of a cone is developed in the same manner as the pyramid.
27. The real length of the edges is unimportant in development.
28. The funnel and pail are based on the pyramid or cone.
29. An object which is neither a parallel nor a regular form is easily developed.
30. Objects developed by triangulation are fully covered in this term's work.
31. Sheet-metal objects are always fastened with rivets.
32. Solder melts at a higher temperature than the metal to be united.
33. Rivets are spread at their end with a wooden mallet.
34. Seams are never used for fastening joints.
35. A butt seam is often used in welding.
36. A butt seam is where the ends meet.
37. A lock seam is usually grooved.
38. Grooving is a machine operation.
39. The standing seam is used for fastening pails and cups.
40. A flange seam is used for the bottom of cylindrical objects
41. Flange seams are single, double, and reverse.
42. An allowance is metal deducted from the net pattern.
43. Heavy solid black lines illustrate the allowance on a pattern.
44. The allowance is usually 5/8 in. wide.
45. Notching is cutting out small parts of allowances.
46. Notching the lap assists in making folds.
47. Laps are usually cut at a 30-deg. angle.
48. Edges and bodies often need to be stiffened.
49. A common method of stiffening is hemming.
50. A hem is riveted to the part to be stiffened.
51. The wired edge is used commonly for stiffening the tops of pails, funnels, and household utensils.
52. A hem may be either single or double.
53. Solder is extensively used for hems.
54. Angle iron is often soldered to metal to promote stiffening.
55. In industry many metal objects are made without seams.
56. Folding or crease lines indicate excess material to be added to the pattern.
57. The six faces of a cube are plane surfaces.
58. The intersection of a cylinder and a cone may be found by passing planes parallel to the horizontal plane.
59. Whenever surfaces come together there is a line of intersection.
60. Cutting planes are used to solve most problems in intersection.
61. All lines are the same thickness when inking a drawing.
62. It is good technique to ink in the circles first.
63. The best way to ink horizontal lines is to use the 45-deg. triangle.
64. The irregular curve is used when drawing circles.
65. In plotting the curve on a pattern, the compass is usually used.
66. The pattern itself should remain in the background on your drawing paper.
67. Always erase the allowance lines after the drawing is completed.
68. Many short cuts are used in making patterns by the sheet-metal worker.
69. The length of an enrolled cylinder may be calculated by mathematics.
70. A cylinder is usually divided into 11 and 23 parts.
71. A regular cone may be cut by planes in four different directions.
72. An ellipse and a parabola resemble each other in appearance.
73. A cone cut perpendicular to the axis forms a circle.
74. A cone cut parallel to the axis forms an ellipse.
75. An element is a line which when moved along a given path, produces a given surface.
76. It is possible to correctly draw a four-piece elbow by using the sheet-metal draftsman's method.
77. Only one method can be used in determining the true length.
78. It is necessary to number all the elements upon curved surfaces.
79. Horizontal lines are parallel with the horizon.
80. Vertical lines are at right angles to horizontal lines.
81. A degree is an angle equal to 1/320 of a circle.
82. A triangle is a figure with four sides and three angles.
83. A right angle contains 93 deg.
84. An angle is the opening between two straight lines which meet.

85. Parallel lines usually meet.
86. Visible edges are the edges of an object shown with dotted lines.
87. Margin lines are always broken lines.
88. The side view is sometimes called an elevation.
89. The top view is sometimes called a "plane."
90. A square has four 90-deg. angles and four unequal sides.
91. A rectangle has four 90-deg. angles and its opposite sides are equal.
92. A cone is a solid whose base is enclosed by a circle.
93. An octagon is a solid with eight sides.
94. A hexagon is a solid with seven sides.
95. When making a pattern for a handle on a cup it is advisable to reinforce or hem it, all round.
96. It is not necessary to stiffen the top edge of the body of the cup.
97. A pattern must be absolutely accurate, when made by a draftsman.
98. It is impossible to be a successful draftsman without considerable knowledge of mathematics.
99. A student is considered to be a draftsman after completing the work in a high school.
100. Practically all professional and engineering professions are based on mechanical drawing.

Key

1. F	26. T	51. T	76. T
2. T	27. F	52. T	77. F
3. T	28. T	53. F	78. T
4. F	29. F	54. F	79. T
5. F	30. F	55. T	80. T
6. T	31. F	56. F	81. F
7. F	32. F	57. T	82. F
8. T	33. F	58. T	83. F
9. F	34. F	59. T	84. T
10. F	35. T	60. T	85. F
11. T	36. T	61. F	86. F
12. T	37. T	62. T	87. F
13. T	38. F	63. F	88. F
14. T	39. F	64. F	89. T
15. F	40. T	65. F	90. F
16. F	41. T	66. F	91. T
17. T	42. F	67. F	92. T
18. F	43. F	68. T	93. T
19. F	44. F	69. T	94. F
20. T	45. T	70. F	95. T
21. T	46. T	71. T	96. F
22. T	47. F	72. F	97. T
23. F	48. T	73. T	98. T
24. T	49. T	74. F	99. F
25. T	50. F	75. T	100. F

METALCRAFT TEST

Harold L. Stiles

High School
Nogales, Ariz.

Part I — Completion Test

Time: 20 minutes

1. This test contains 50 incomplete statements from which certain words have been omitted.
2. The blank spaces show where the words have been left out.
3. You are to write, on the blank spaces, the words which have been left out.
4. Study the sample carefully before beginning actual work.

Sample: The tin snips are used to cut thin sheet metal.

Test statements:

1. The size of soldering coppers are determined by their .....
2. Galvanized iron or steel is coated with .....
3. Monel metal is used in kitchens because it will not .....
4. Lead is one of the ..... and softest of common metals.
5. Ore boats leaving Duluth must pass through the ..... Canal before they reach Chicago.
6. Stove pipes are usually made of black .....
7. Coke is a trade name for .....
8. Hammering copper makes it ..... while heating makes it soft.
9. A common trade name for pewter is .....
10. Brass is an alloy of copper and .....
11. Soldering fluxes are used to dissolve the ..... which form on the surface of metal.
12. Cut acid is formed by mixing zinc with ..... acid.
13. Rosin and ..... are used as a flux when soldering lead.
14. The soldering iron may be cleaned by dipping it in a weak solution of ..... and water when it is hot.
15. Solder fuses at a temperature ranging from ..... to 550 deg. F.
16. Solders are classified as common, medium, and .....
17. Medium solder is composed of 50 per cent lead and 50 per cent .....
18. Softening copper by heating and dipping it in cold water is called .....
19. Rosin is obtained from the ..... of trees.
20. Tinners rivets are made of soft ..... or steel.
21. Tinners rivets are classified according to the weight per ..... rivets.
22. The size of tinners rivets may vary from 4 oz. to ..... pounds.
23. The length of tinners flathead rivets vary from ⅛ in. to ..... in.
24. Stove bolts may be purchased with either flat or ..... head.
25. Self-tapping ..... are rapidly replacing bolts and rivets in the sheet-metal industry.
26. One of the most difficult metals to solder is .....
27. To forge the point of a soldering copper, it should be heated to a bright ..... color.
28. Blast furnaces are used to reduce iron ore to ..... iron.
29. Inside curves are cut with ..... snips.
30. Hold the rule on its ..... when accurate distances are to be laid off on a piece of metal.
31. The soldering copper can be cleaned by rubbing it on a cake of ..... while the iron is hot.
32. When soldering an overhead seam only one ..... of the copper should be tinned.
33. Soldering irons are made of .....
34. The term ..... is used when speaking of cutting metal in sheet-metal work.
35. One of the common wire gauges is the American or ..... and Sharpe.
36. The thickness of galvanized sheet iron varies from 10 gauge to 32 gauge, the heaviest being ..... gauge.
37. The thickness of wire varies from No. ..... to No. 30.
38. Bronze is an alloy of copper and .....
39. The two common systems of measure used in this country are the English and the ..... systems.
40. The ..... are used to draw circles on sheet metal.
41. The vertical divisions on the sleeve of the micrometer are ..... of an inch apart.
42. The venier scale on the micrometer reads to the ..... part of an inch.
43. Coating a soldering copper with solder is called .....
44. A No. ..... hand groover is used in making a ⅛-in. groove.
45. The layout for rivet holes should be made with a ..... punch.
46. Steel is an alloy of iron and .....
47. Dirt and iron ..... mixed together form iron ore.
48. The quantity and kind of ..... determine the value of the ore.
49. A man by the name of ..... invented the process of converting iron into steel.
50. The largest percentage of the iron ore used in the United States comes from the ..... region.

Score: number right: .....

Key — Part I

1. weight	26. aluminum
2. zinc	27. red
3. rust or corrode	28. pig
4. heaviest	29. curved or hawkbill
5. Soo	30. edge
6. iron	31. sal ammoniac
7. tin	32. side
8. hard	33. copper
9. Britannica	34. shearing
10. zinc	35. Brown
11. oxides	36. 10
12. hydrochloric	37. 4/0
13. tallow	38. tin
14. sal ammoniac	39. metric
15. 380	40. dividers
16. fine	41. 1/40th
17. tin	42. ten thousandth
18. annealing	43. tinning
19. sap	44. No. 6
20. iron	45. prick
21. 1000	46. carbon
22. 12	47. rust or oxide
23. ½	48. dirt
24. round	49. Bessemer
25. screws	50. Lake Superior

Part II — True-False Metalcraft Test

Time: 10 minutes

1. This part of the test contains 25 true-false statements.
2. Read each statement carefully.
3. If you think that the statement is true, put a plus (+) in the parenthesis before the statement.
4. If you think the statement is false, put a zero (0) in the parenthesis before the statement.
5. Study the samples carefully before beginning actual work.

Samples:

(+) 1. The tin snips are used to cut thin sheet metal.
(0) 2. Copper is an alloy.

Test Statements

( ) 1. Hand seamers are used for making folds on small pieces of metal.

( ) 2. A scriber is used for laying out circles.
( ) 3. Planishing adds both strength and beauty to metal.
( ) 4. A No. 2/0 rivet set is larger than a No. 8 rivet set.
( ) 5. IC grade tin is heavier than XXXX grade tin.
( ) 6. Charcoal tin has a heavier coating of tin than coke plate.
( ) 7. A 36-gauge copper is thicker than 14-gauge copper.
( ) 8. Nickel silver is made of 64 per cent copper, 18 per cent silver, and 18 per cent nickel.
( ) 9. Brass is an alloy.
( ) 10. Both ends of the bleak horn stake are rounded.
( ) 11. No. 20-gauge wire is larger than No. 10-gauge wire.
( ) 12. Hard solder is an alloy of zinc, copper, and silver.
( ) 13. Zinc is commonly known as spelter.
( ) 14. Soldering iron tips were formerly made of iron instead of copper.
( ) 15. Heating will clean an iron sufficiently for tinning.
( ) 16. The soldering iron should be heated until it becomes redhot before using.
( ) 17. The soldering iron is used when hard soldering.
( ) 18. Powdered rosin is recommended as a flux for soldering aluminum.
( ) 19. The rivet set is used to make round ends on rivets.
( ) 20. Bench shears are used for cutting heavy metal.
( ) 21. The size of sheet-metal screws are determined by their gauge diameter and length.
( ) 22. The medium grade of solder is composed of tin and lead in equal amounts.
( ) 23. Soldering salts are applied directly to the metal which is being soldered.
( ) 24. Zinc melts at about 450 deg. F.
( ) 25. Hand groovers are used for making folded seams.

Score; R — one half W: .....

Key — Part II

1. (+)	6. (+)	11. (0)	16. (0)	21. (+)
2. (0)	7. (0)	12. (+)	17. (0)	22. (+)
3. (+)	8. (0)	13. (+)	18. (0)	23. (0)
4. (0)	9. (+)	14. (+)	19. (+)	24. (+)
5. (+)	10. (0)	15. (0)	20. (+)	25. (+)

Problems and Projects

A BLUEPRINT-PAPER DISPENSER

R. C. Roe
Jesup W. Scott High School
Toledo, Ohio

The blueprint-paper dispenser described herewith has solved a bothersome problem in the drafting room at the Jesup W. Scott High School, Toledo, Ohio. It may be found equally helpful elsewhere.

The blueprint paper is purchased in 50-yd. rolls in 36-in. widths. It is then cut into 3 rolls, each 12 in. wide. A roll of it is then placed into the dispenser, from which the paper may be pulled out to any desired length and torn off.

With this dispenser at hand there need be no further worry that the paper will be exposed to deteriorate in the daylight, or that it will fall off the desk and unroll on the floor.

THREE METAL ASH TRAYS

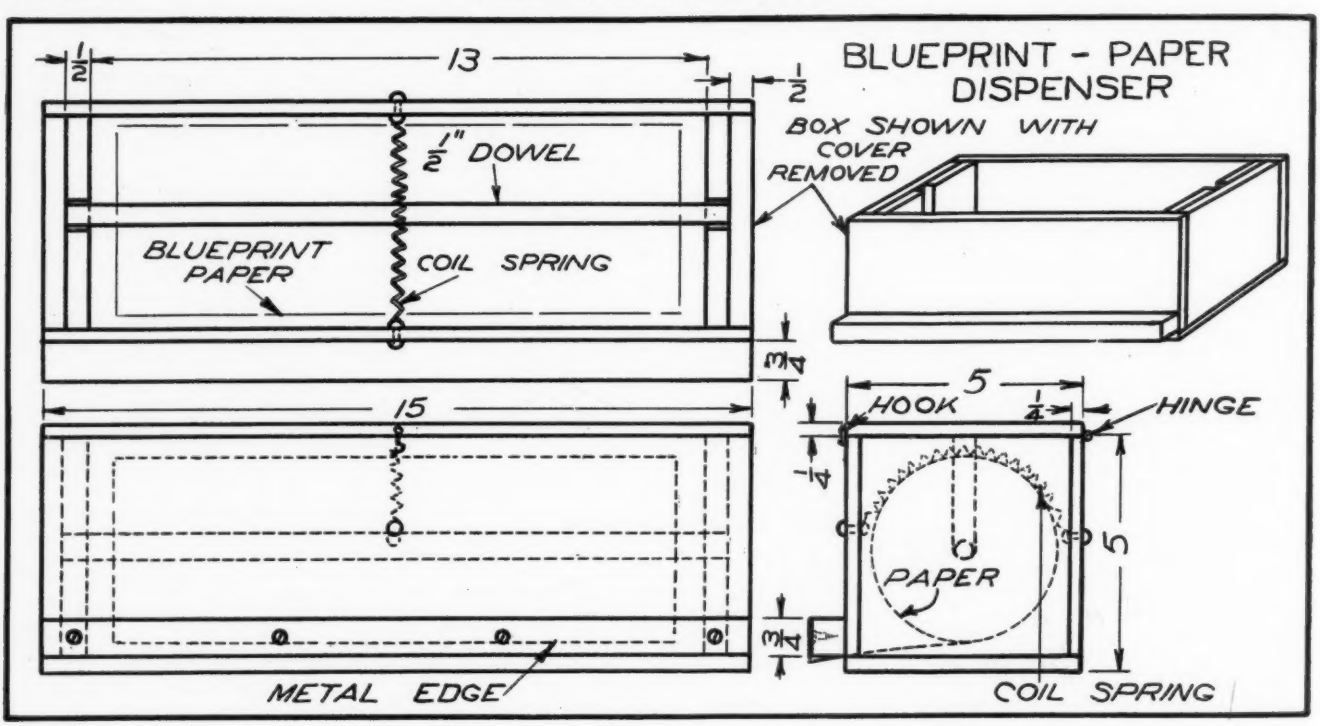
E. L. Longley
Baltimore, Md.

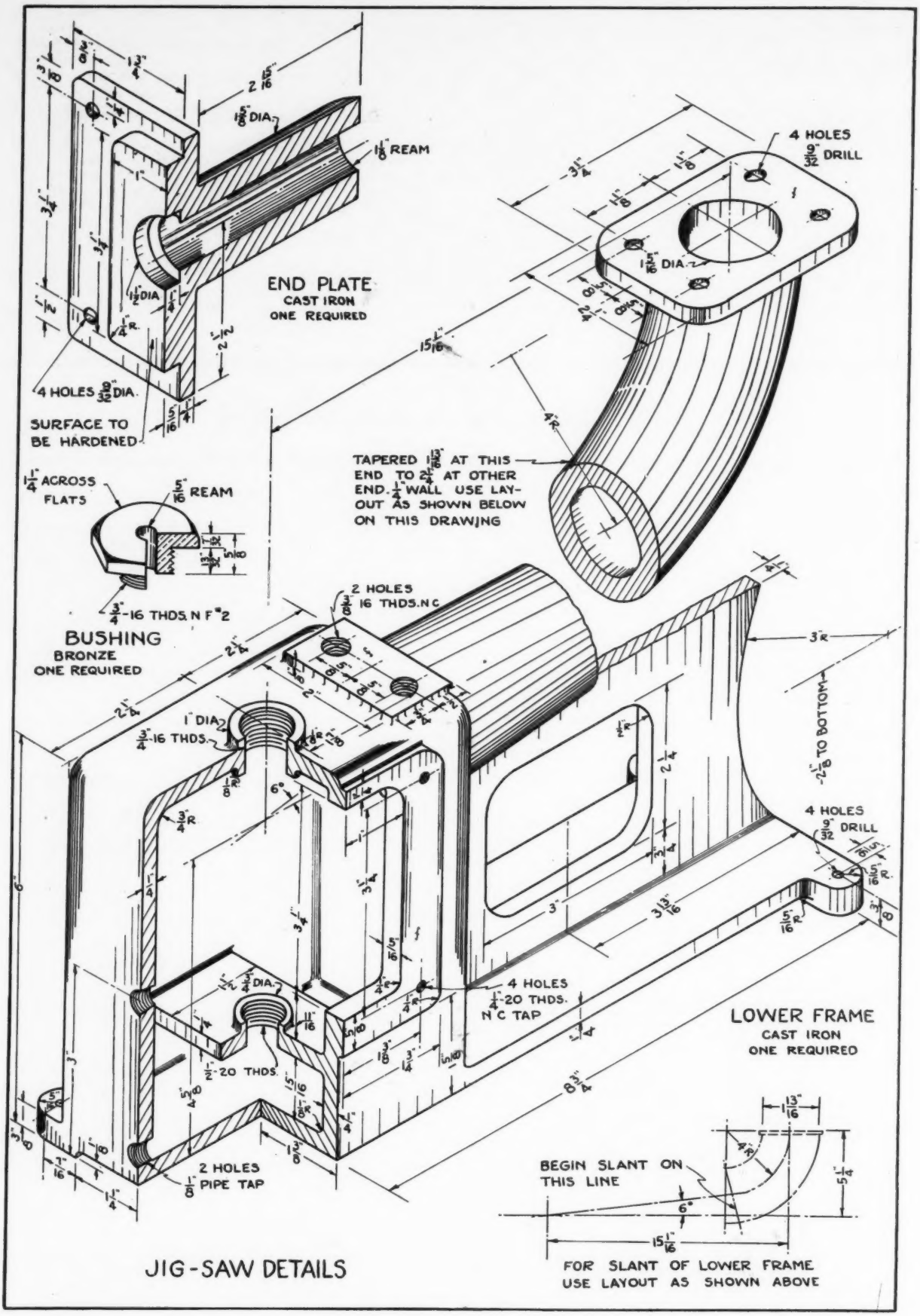
The three ash trays shown are new and different.

The first one is a model grocer's scoop. It may be made of 16-oz. copper, cut as shown in Figure 1. After laying out and cutting the plank, it is formed into a cylinder. The seam may be made by grooving, lapping and soldering, or lapping and riveting. After the body has been formed, find its diameter, and then make the circular back of the same weight material, but cut ¼ in. larger than the measured diameter. This measuring must be done accurately. The circular disk is then burred (edge turned at right angles) a scant ⅛ in. It is then slipped over the end of the cylinder and sweated in place. A circular wooden disk could also be cut and set into the cylinder and braced in as a back.

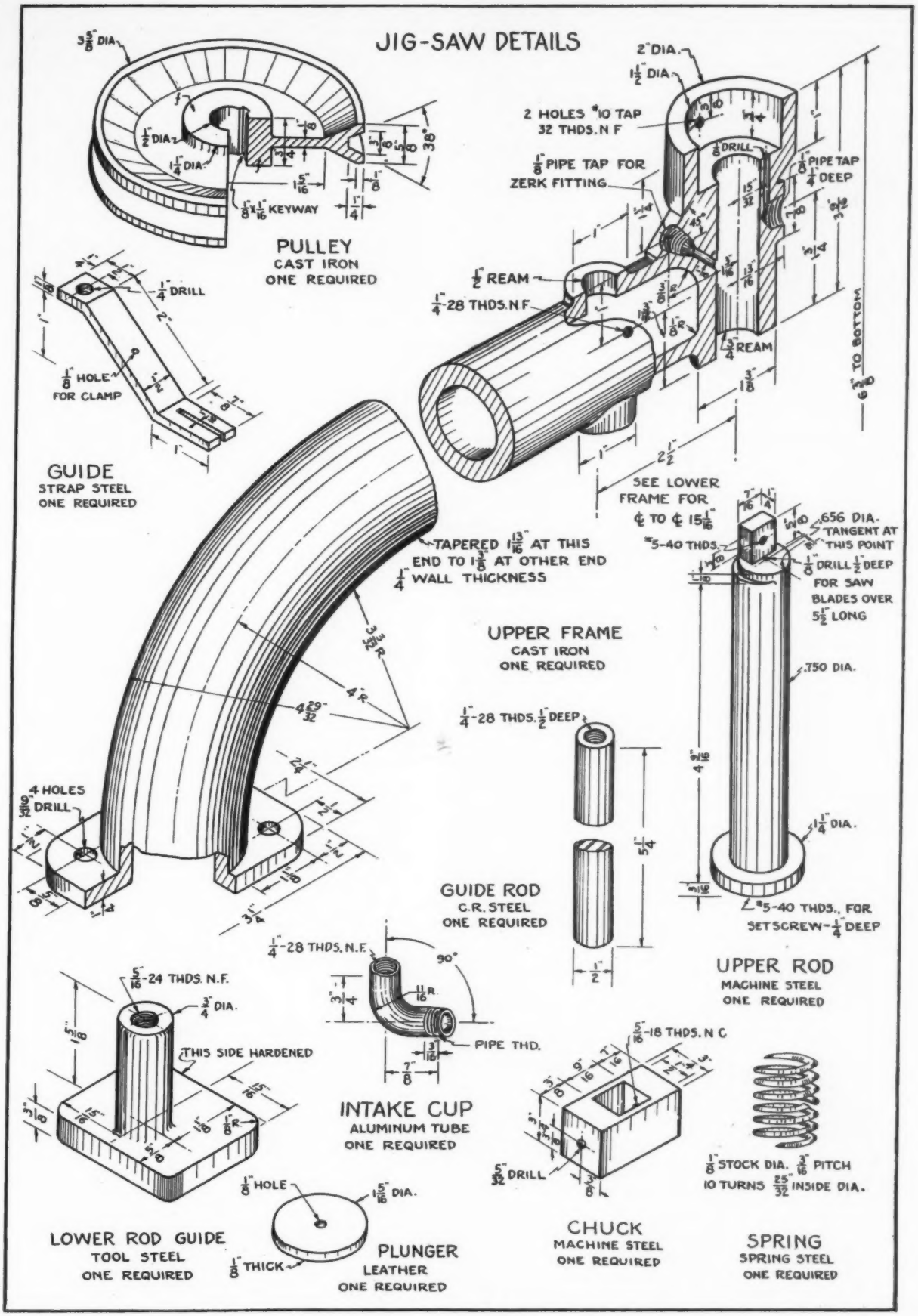
For the base a block of wood is turned and polished as shown in Figure 2. Other designs, of course, may be made but this is found to be in keeping with the scoop as shown. The

(Continued on page 27)

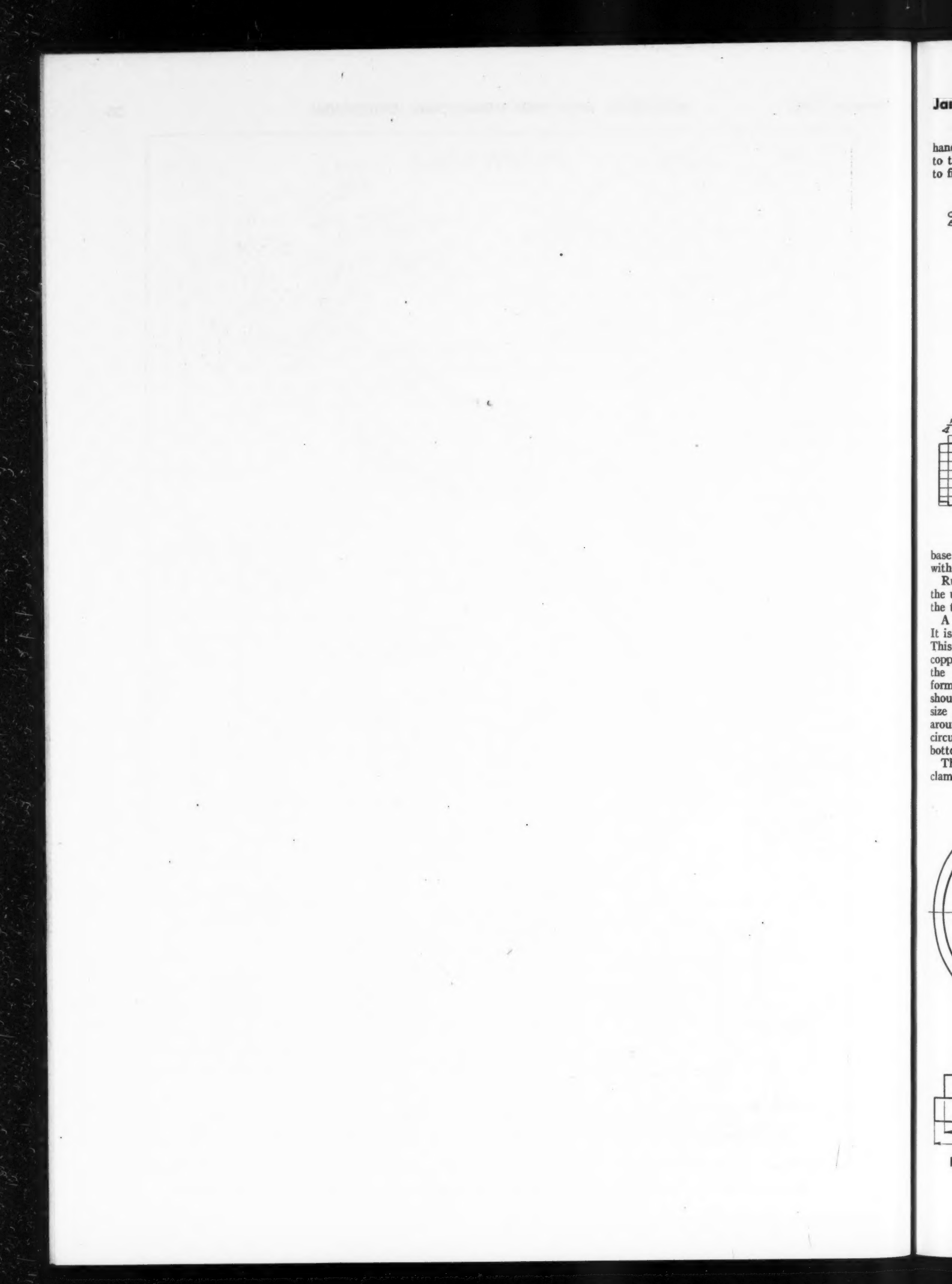



END PLATE
CAST IRON
ONE REQUIRED
4 HOLES 9/32 DRILL
4 HOLES 9/32 DIA.
SURFACE TO BE HARDENED
TAPERED 1 13/16" AT THIS END TO 2 1/4" AT OTHER END. 1/4" WALL USE LAY-OUT AS SHOWN BELOW ON THIS DRAWING
BUSHING
BRONZE
ONE REQUIRED
2 HOLES 16 THDS. N C
4 HOLES 9/32 DRILL
4 HOLES 1/4-20 THDS. N C TAP
LOWER FRAME
CAST IRON
ONE REQUIRED
2 HOLES 1/8 PIPE TAP
BEGIN SLANT ON THIS LINE
FOR SLANT OF LOWER FRAME USE LAYOUT AS SHOWN ABOVE
JIG-SAW DETAILS

Jig-Saw details by Frank E. Anthony, instructor, Technical High School, Erie, Pa. For description see page 386 of the November, 1941, issue



Jig-Saw details by Frank E. Anthony, instructor, Technical High School, Erie, Pa. For description see page 386 of the November, 1941, issue



(Concluded from page 22)

handle is made of wood, turned on the lathe to the shape shown in Figure 3. Cut the end to fit flat against the back of the scoop. Both

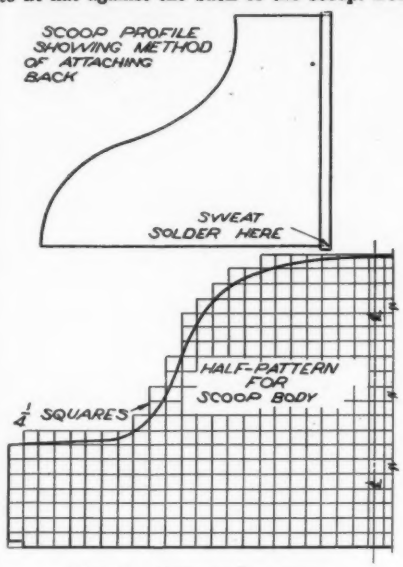


Fig. 1. Layout for scoop

base and handle are attached to the scoop with small r.h. brass screws.

Rubber-headed tacks or a piece of felt on the underside of the base will prevent marring the table on which the ash tray is placed.

A second project is a miniature ash can. It is made 2½ in. in diameter and 4 in. high. This ash tray may also be made of 16-oz. copper. The corners are notched as shown in the details in Figure 5. The metal is then formed into a cylinder and riveted. The sides should then be crimped to imitate the large-size ash can. A band of brass is sweated around the top and bottom edges, and a circular disk is cut and soldered into the bottom.

The handles are rings made of wire and clamped with pliers in a piece of copper, allowing the ring to move as a hinge. Rivet the handles in place as shown.

The entire project is then polished with No. 2/0 steel wool, and waxed or lacquered.

The third project is a miniature hooded dustpan. Figure 7 gives all dimensions for this project. The material is preferably made of 12-oz. copper. After cutting the metal, seam the edges, form to shape, and solder where necessary. The handle is made of the same weight material. It is seamed, then formed as shown, and then soldered to the body.

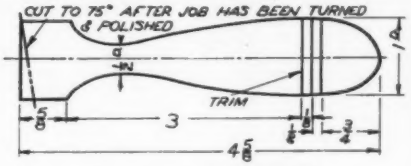


Fig. 3. Scoop handle

The base, shown in Figure 8, may be turned of any suitable wood. It should be polished while on the lathe. Cut notch with backsaw to fit the pan, and fasten the latter in place with small r.h. brass screws. The bottom of

Fig. 4. The scoop ash tray with base

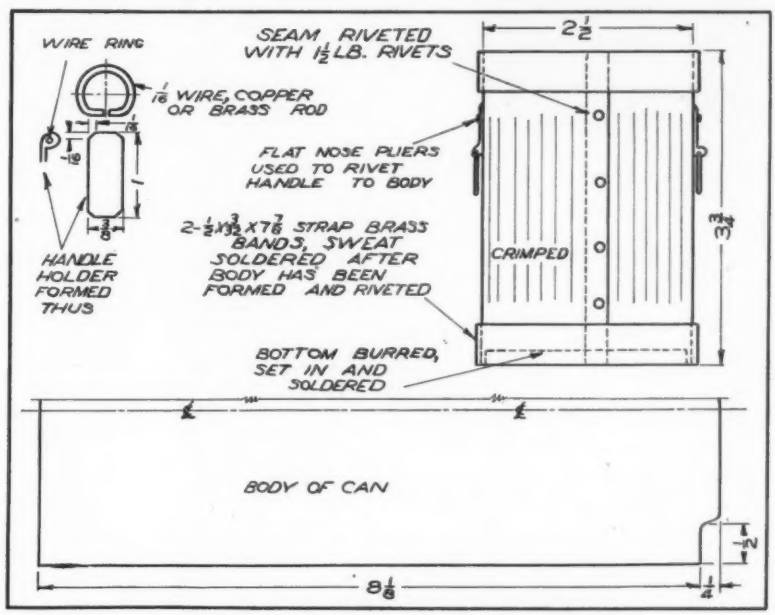

WIRE RING
1/16 WIRE, COPPER OR BRASS ROD
SEAM RIVETED WITH 1/2 LB. RIVETS
2 1/2
FLAT NOSE PLIERS USED TO RIVET HANDLE TO BODY
2-1/2 X 3/32 X 7/8 STRAP BRASS BANDS, SWEAT SOLDERED AFTER BODY HAS BEEN FORMED AND RIVETED
CRIMPED
3 3/4
HANDLE HOLDER FORMED THUS
BOTTOM BURRED, SET IN AND SOLDERED
BODY OF CAN
8 1/8

Fig. 5. Layout for ash can

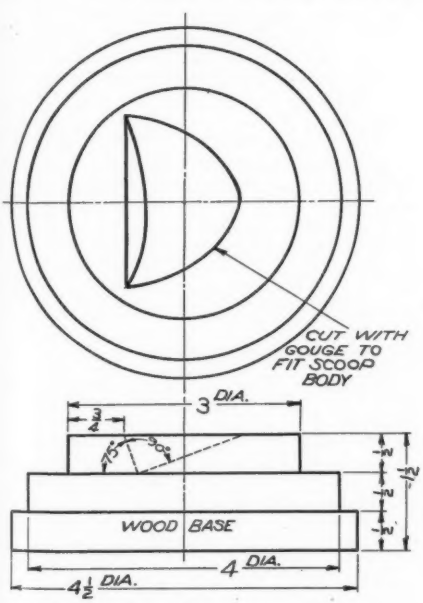


Fig. 2. Base for scoop ash tray

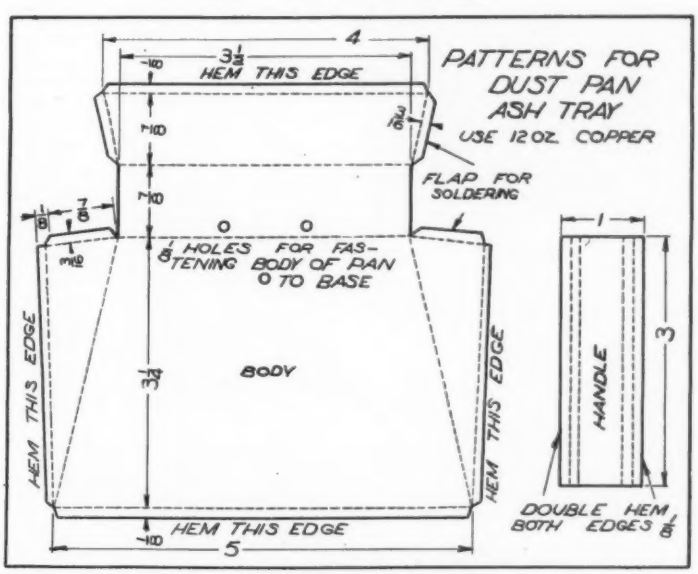


Fig. 7. Layout for dust pan

this base may be protected with rubber-headed tacks or felt, so that the ash tray will not mar any surface on which it may be placed.

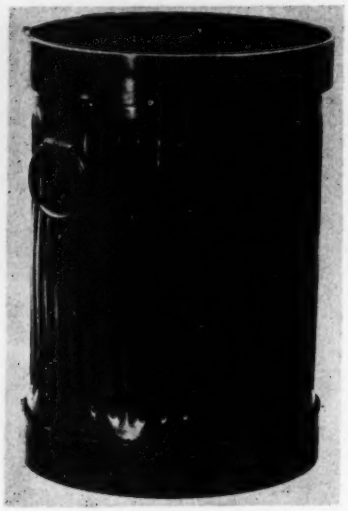


Fig. 6. The finished ash tray

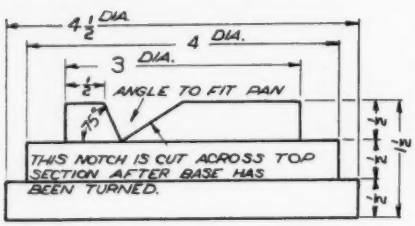


Fig. 8. Base for the dust-pan ash tray

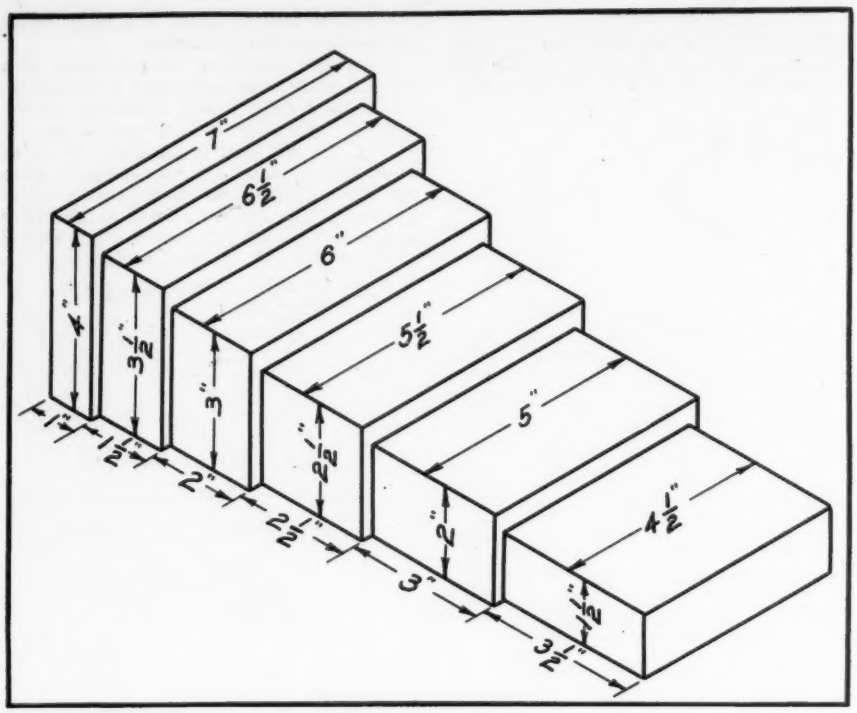
Fig. 9. The dust-pan ash tray

THE SIZE OF DRAWING MODELS

W. W. Sturtevant
South High School
Minneapolis, Minn.

In selecting models, or in working up exercises for beginning pupils to draw, the size of the models should be considered. The drawing should space well on the sheet if the finished plate is to present an attractive appearance.

For the earlier plates to be drawn by inexperienced pupils it is well to give the distance between views and the distance from the border lines to the edges of the drawing.



Drawing exercises

The spacing of the drawing on the sheet is of importance as it affects the appearance of the plate to a considerable extent. More advanced pupils should be taught to calculate the space occupied by the several views of the drawing and to figure the correct space between the views and at the margins. However, for the beginning pupil who is trying to fix in his mind the relation of the different views to each other, and who must learn the meaning of the different lines which are to be used on a given drawing this problem of spacing tends to confuse.

When the exercises to be drawn are carefully selected, a set of a number of plates may be given in which the spacing is exactly the same. If the instructor selects for the first exercise block one of such a size that the space between views and at the margins is 1 in., one less problem is presented to the boy. For instance, if the sheet used is 9 by 12 in. with a ½-in. border, the space within the border lines is 8 by 11. If a block 1 by 4 by 7 in. is used as an exercise, the combined length and thickness, 7 + 1, is 8 in. and this subtracted from the width of the sheet leaves 3 in. to be equally divided for the space between views and the two margins at right and left.

The vertical spacing will work out in the same way as the height and thickness; 4 + 1, is 5 in. which, when subtracted from 8 in. leaves 3 in. to be divided equally into space between views and a margin at top and bottom.

Pupils find the exercises of more interest if they are of different sizes and it is an easy matter to work out the dimensions for a set of exercise blocks which will space the same on the sheet and still offer a variety of shapes and sizes.

The illustration shows a series of blocks that will fit well into the same space as in all of them the combined length and thickness, and the combined height and thickness are the same.

These blocks may be varied by cutting them into different shapes so that they present a number of different drawing problems but each will have the same over-all dimensions and consequently will relieve the pupil of the problem of figuring the spacing until he has learned the basic principles of drawing.

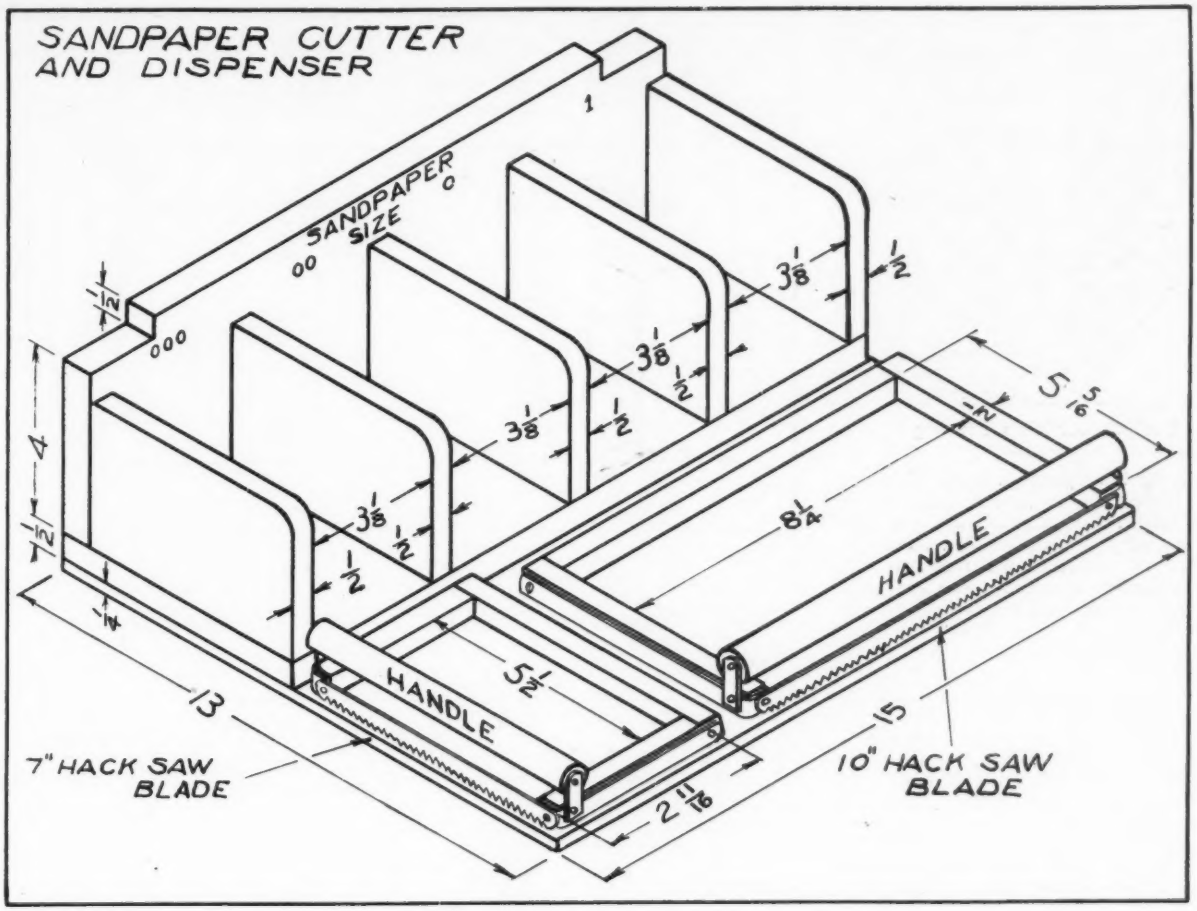
SANDPAPER CUTTER AND DISPENSER

Russell J. Hunt,
New Baltimore, Mich.

The cutter and storage cabinet described herewith has helped to solve the sandpaper problem at my school, and it may be of help to others.

With this cutter, the stock clerk can quickly tear full sheets up into neat pieces to fit the sanding blocks. Each grade of abrasive paper may be placed in its proper place as it is torn. A printed instruction sheet is hung above the cutter, in case anyone is not sure of the proper grade to use. This instruction sheet is very helpful. It saves time, questions, and confusion in the shop. Before the stock clerk gives out any new sandpaper the student is required to return the used piece to the clerk, who places it in a small box constructed for this purpose and punches the recipient's fee card.

Junior high school students are mechanically minded and enjoy using this teaching device. The stock clerk likes the authority and responsibility connected with the job. The recipients of the sandpaper can see the necessity of knowing the different grades of paper. The students feel a sense of satisfaction and pleasure in using this device which produces quick accurate results.



WOOD CARVING

Hester Newey,

Instructor in Wood Carving,

Kittery, Me.

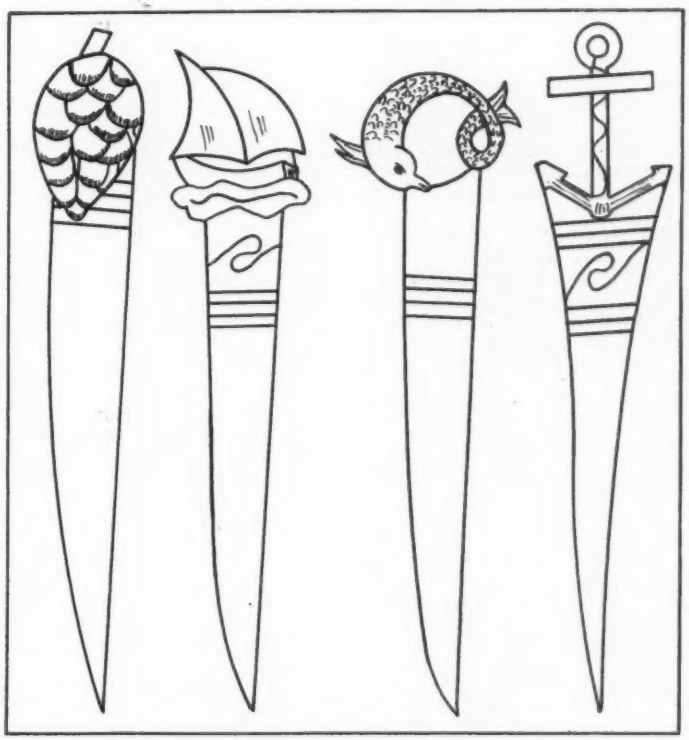
In the fall, a group of people met with the superintendent of schools to plan for the formation of a wood-carving class. The superintendent consulted the members of the school board, and we were given permission to meet one night each week at the new manual-training rooms at Traip Academy. Here we are working under the most modern conditions. Two persons work at each bench. Each bench is equipped with vise and bench dogs.

We started with 16 registered pupils. Our class period requirements are three hours, from 6:30 to 9:30 one evening each week. The cost to the pupil is 25 cents; the remainder of the instructor's pay is furnished by the state.

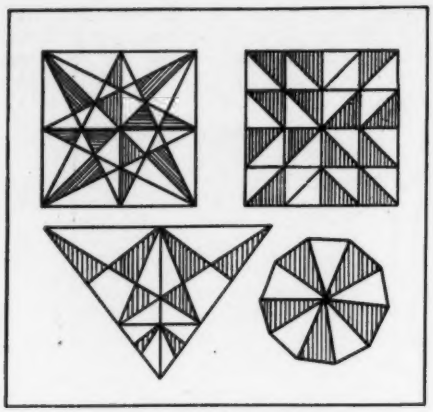
The average attendance has been 13, an excellent record, showing a vast degree of interest, especially during winter months.

The average cost of tools has been less than $5 per person, each one purchasing one parting tool, one veiner, and four straight gouges. These, when necessary, have been supplemented by the loan of tools from the instructor's kit.

Each pupil is required to sharpen his own tools and keep them in excellent condition. We use fine slip and oilstones for sharpening. In addition, we have made a small box



Designs for paper knives



Designs for chip carving

in which we have placed a piece of belting leather. Over this we poured clear, melted mutton tallow. Into the tallow we worked as much emery dust as possible. After this has been well worked into the leather it needs no further care, and a few strokes of the gouge or chisel over this medium will assure a keen cutting edge. An excellent guide for sharpening is to take two thirds of the strokes on the outside, and one third on the inside of the cutting edge. A long bevel on carving tools is much to be desired.

A record is kept of each project that is completed by a pupil, with the amount of time required. Few of the pupils have an opportunity, chiefly from lack of benches or home workshops, to do homework. However, satisfactory work has been accomplished and several of the pupils have proved exceptionally clever in designing and carving projects.

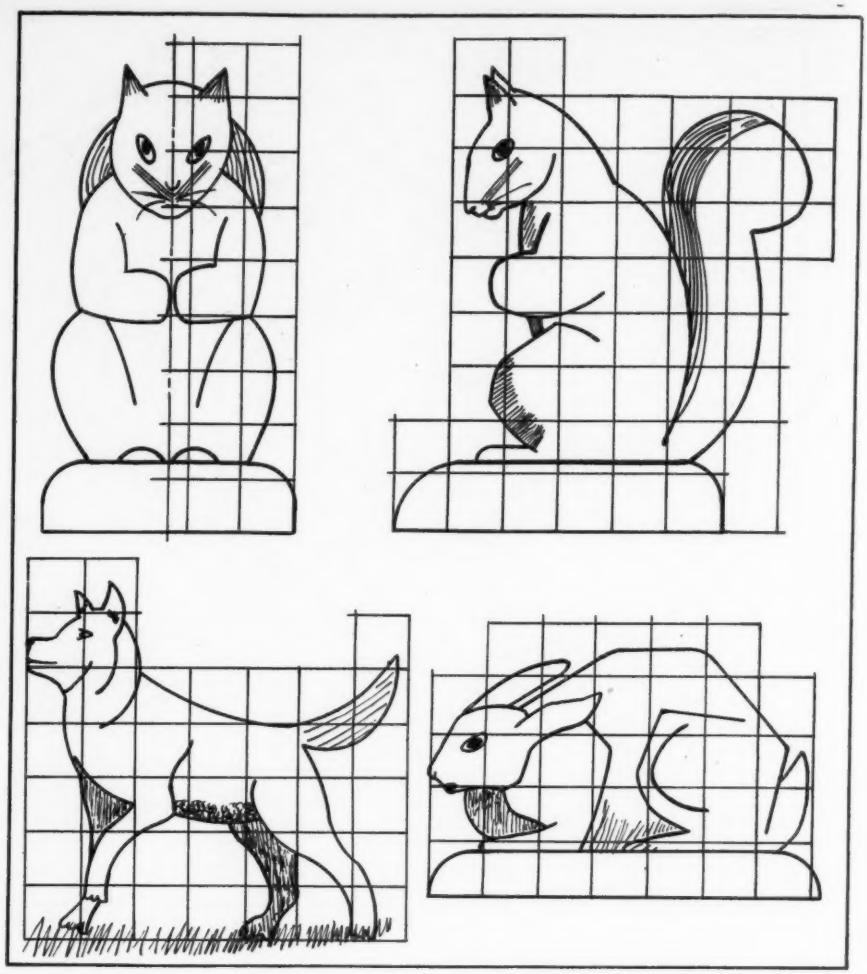
The first project was a tray made in the shape of a leaf. This accustomed each individual to the use of his tools, and trained his judgment in proportion and depth. Before using tools each one was taught to observe grains of various woods, and the advantages of working with the grain. Also the proper method of grasping the tools.

Other projects have been large and small trays, wall plaques, trinket boxes, book covers, mixing spoons, calendar pads, candy dishes, and the like.

One person has developed great skill in carving in the round, and has finished an elephant about 15 in. long and 12 in. tall, carved from a solid block of wood. He is now doing a horse. Another beautiful article, nearing completion, is a tray with a grape-leaf design, the grapes and stem forming the handles.

We try to use representative local designs. As we are located on the seacoast, we use patterns like ships, gulls, shells, and starfish. We have used designs from local historical houses, on box tops. At present one member of the class is working out the pattern of our own old Fort McClary as a book-cover design. Still another is doing a shield with a naval insignia upon it.

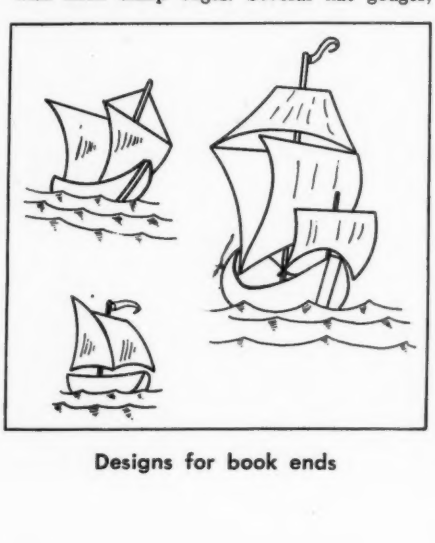
It is required that each article be finished not only to look well, but to be smooth to the touch. Some of the articles have been treated to several coats of boiled linseed oil, put on hot, with much rubbing and polishing between each coat. Our favorite finish is obtained by applying about four coats of best-grade varnish. Each coat is well dried and sanded before another is applied. After the last coat the article is well rubbed with ground pumice and oil. This removes the high gloss and gives a satin-smooth finish.



Patterns of squirrel, rabbit, and dog to be carved in the round

Some of the pupils have already sold articles that they have completed. In the few weeks of study we find unsuspected talent being developed, and a pleasant companionship amongst a group of comparative strangers has been formed.

The wood carver, first of all, needs tools with keen sharp edges. Several flat gouges, a parting tool, and a veiner, will be a fair kit with which to start operations.



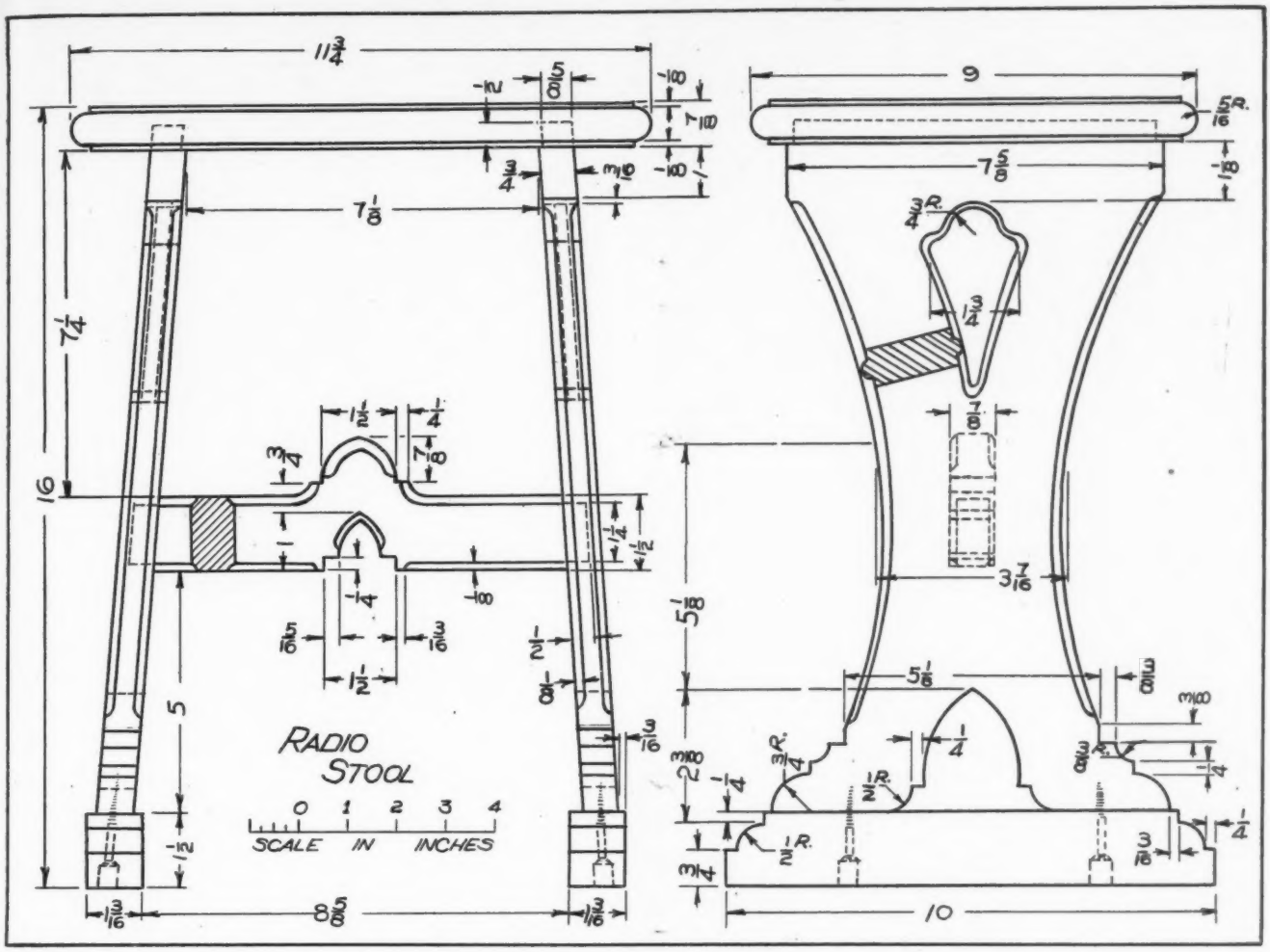
Designs for book ends

It is desirable to have a workbench located in a direct light, under a window, if possible. Average height of bench should be about 38 to 40 in. It is well to place a paper or cardboard between the bench and work. This will prevent accidental slips of the tool from marring the bench. Several sizes of clamps are a necessity, and a bench vise will be a great convenience. A pad of hard rubber, or a piece of thick cardboard should always be placed between the wood and the clamp. Have handles of all tools smooth and highly polished to prevent scratching the hands.

Make a carver's mallet from strong, tough-fibered wood. Maple, or apple-tree wood are excellent for the purpose.

Carving chisels should always be sharpened with a long bevel, both sides being sharpened to get a thin, keen edge. The inside is sharpened only to remove the slight burr upon the edge. A well-sharpened tool gives a clean cut when drawn across the crosswise grain of softwood. A fine carborundum stone and two or three small slip stones, and a stropping block, are a necessary part of the bench equipment. Do not forget to wipe the oil off the stones and return them to their respective boxes after using.

Tools should be placed on the bench with points nearest the carver, in order that a glance at the points will be sufficient to make



Radio stool designed by Earl W. Boyer

the proper selection. Be careful that tools do not touch each other, and thus ruin their keen cutting edges.

Whitewood, black walnut, and mahogany are very good woods for carving, and take a beautiful finish.

To become accustomed to the use of tools it is best to start with a simple design. Shaping and gouging out a tray makes good practice for a beginner. Simple surface carving with a well-chosen design may be used as a decoration.

For high relief carving the design is outlined and then modeled. The background is removed, leaving the design as a complete, raised unit.

Chip carving is really a series of clean, sharp cuts, usually in geometrical patterns. These lines have to be cut accurately with a chisel. Care should be taken that pieces are not broken, thus spoiling the delicate rendering of the design.

Designs are based upon the following principal motifs: The spiral, straight line, circle, half circle, zigzag line, wavy line, and lines in the shape of the letter *S*.

When planning the design consider the utility of the article, the correct proportion, and the material to be used.

The design should be well balanced and symmetrical, and so placed as to give a feeling of contentment and peace.

RADIO STOOL

Earl W. Boyer,

Williamson School, Pa.

This little stool has proved to be useful as a radio stool and as a telephone stool.

It is an interesting project to make and the result is an attractive piece of furniture. Mahogany or walnut may be used. The pieces are all shaped and sanded before assembly. Mortise-and-tenon joints are used throughout, but the two base pieces could be secured by means of countersunk headscrews. The seat piece might also be fastened to the end-pieces by means of small iron angles and screws instead of the tenon. All the beveled edges shown, as well as the molding on the seat board, were produced with a Carter router.

HISTORY OF THE AUGER BIT

Carl v. Lindeman,

Western State Teachers College, Paw Paw, Mich.

The first boring tool is assumed to have been an awl made of stone or bone. The first gimlet was invented in 1240 B.C. by Daedalus. See Figure 1. It had no screw point, but it had a hollow pod and a crosshead forming a handle. Awls were found in Egyptian tombs dating from 1706 to 1490 B.C. It was many years after the invention of the gimlet before the screw point shown in Figure 2 was added, and only within recent years the twist shank has been added, which now makes it self-discharging. The auger was a Greek tool and

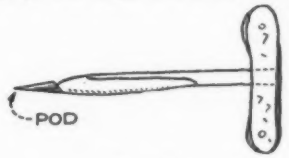


Fig. 1

Fig. 2

from early description it appears to have been considered a shipwright's tool. It formerly had a curve, sharpened end, and a concavity to hold the chips, and was known as a *pod* auger. To this a lip was subsequently added for certain kinds of boring, and in the course of time the depressions grew into a spiral, which allowed the chips

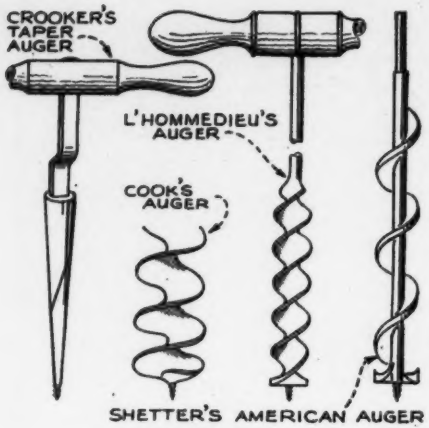


Fig. 3

to escape while the boring proceeded instead of having to withdraw the tool as the pod became filled. The *twisted* auger is an American invention, and was made by Lilley of Mansfield, Conn., about the beginning of the present century. In the year 1809, L'Hommedieu developed an auger with two pods, two cutting lips, and a center screw. This auger was known as the best until the year 1831, when a patent was granted to Shelter for a new and improved auger called the *American*. This auger had a spiral blade around a cylindrical core and it became a favorite with the workmen of those days, until later inventions proved that this type offered more impediment to the discharge of the chips than did the one with a shank made from a flat blade twisted into a spiral. The above illustrations show the shape of the different augers developed during the process of the evolution of this tool.

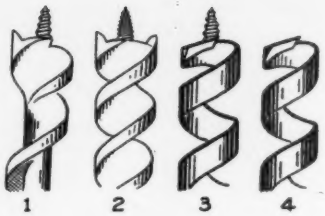
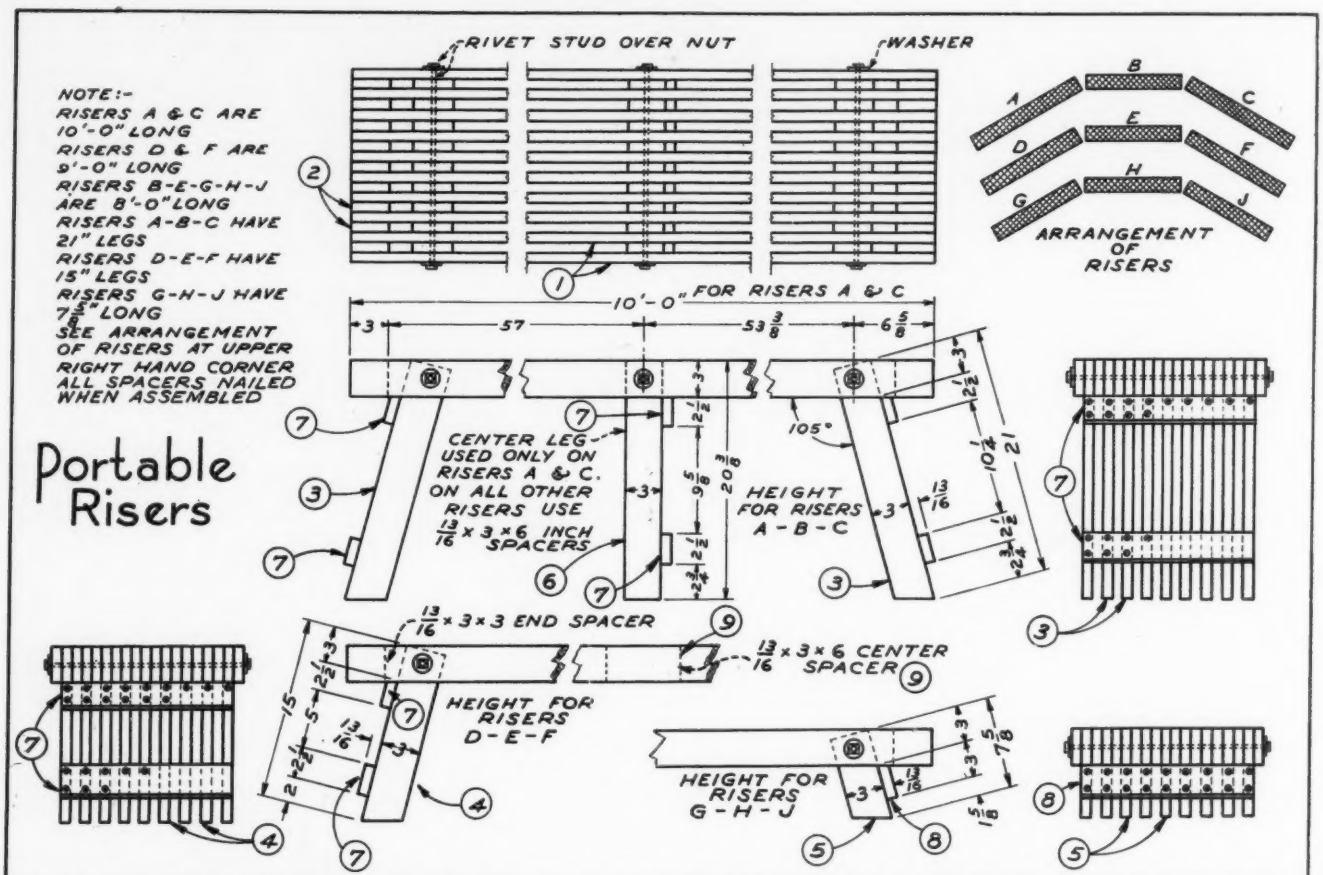


Fig. 4

1. Single cutter, extension lip, coarse thread, used for general all-around boring
2. Double cutter, extension lip, fine screw. Recommended for cabinet work
3. Ship head with single cutter coarse screw, used for deep boring in wood with strong grain
4. Ship head, single cutter without either screw or lip


NOTE:-
RISERS A & C ARE 10'-0" LONG
RISERS D & F ARE 9'-0" LONG
RISERS B-E-G-H-J ARE 8'-0" LONG
RISERS A-B-C HAVE 21" LEGS
RISERS D-E-F HAVE 15" LEGS
RISERS G-H-J HAVE 7 5/8" LONG
SEE ARRANGEMENT OF RISERS AT UPPER RIGHT HAND CORNER
ALL SPACERS NAILED WHEN ASSEMBLED
Portable Risers
RIVET STUD OVER NUT
WASHER
ARRANGEMENT OF RISERS
10'-0" FOR RISERS A & C
CENTER LEG USED ONLY ON RISERS A & C. ON ALL OTHER RISERS USE 13/16 x 3 x 6 INCH SPACERS
HEIGHT FOR RISERS A-B-C
13/16 x 3 x 3 END SPACER
13/16 x 3 x 6 CENTER SPACER
HEIGHT FOR RISERS D-E-F
HEIGHT FOR RISERS G-H-J

PART NO.	REQ'D.	SIZE T	SIZE W	SIZE L	BD. FT.	NAME
1 FOR RISERS B-E-G-H-J	50	13/16"	3"	8'-0"	100	TOP SLATS
FOR RISERS D-F	20	13/16"	3"	9'-0"	45	TOP SLATS
FOR RISERS A-C	20	13/16"	3"	10'-0"	50	TOP SLATS
2	162	13/16"	3"	3"	10 1/4	END SPACERS
3	54	13/16"	3"	21"	23 3/4	LONG LEGS
4	54	13/16"	3"	15"	17	MEDIUM LEGS

PART NO.	REQ'D.	SIZE T	SIZE W	SIZE L	BD. FT.	NAME
5	54	13/16"	3"	7 5/8"	8 3/4	SMALL LEGS
6	18	13/16"	3"	20 3/8"	7 3/4	CENTER LEGS
7	28	13/16"	2 1/2"	13 13/16"	8	LEG BRACES
8	6	13/16"	3"	13 13/16"	1 3/4	LEG BRACES
9	63	13/16"	3"	6"	7 1/2	CENTER BRACES
	612	NO. 9-1 1/2" FLAT HEAD SCREWS				
	20	3/8" x 17" THROUGH BOLTS				
	40	WASHERS AND NUTS TO FIT STUDS				

Portable risers designed by J. H. McCloskey, Lakewood, Ohio

A MODERNISTIC TWO-TONE LAMP

Harold M. Gray
Simmons School
St. Louis, Mo.

The modernistic two-tone lamp, shown in Figure 1, is an easy job for the careful student or craftsman.

All material is selected, dressed, and glued as is shown in Figure 2. This lumber should be kept in clamps from 24 to 48 hours. At the end of this time, the stem and base are placed in the lathe and turned to the measurements indicated in Figure 2.

The holes for the electric wire and fixtures are then drilled, and the lamp is assembled and glued. After a thorough sanding the lamp is shellacked and waxed twice. Each coat of shellac is rubbed down after shellacking, a coat of clear varnish is applied, and rubbed down. The final step is the application of a coat of wax.

Bill of Material

No. Required	*Material*	*Size*
3 pc.	Walnut	1 x 5 x 12¼ in.
2 pc.	Maple	1 x 5 x 12¼ in.
2 pc.	Maple	1 x 4½ x 5 in.
2 pc.	Maple	1 x 1 x 5 in.
1 pc.	Maple	1 x 5¾ x 5¾ in.
1 pc.	Walnut	1 x 6¾ x 6¾ in.

Fig. 1. Two-tone lamp base

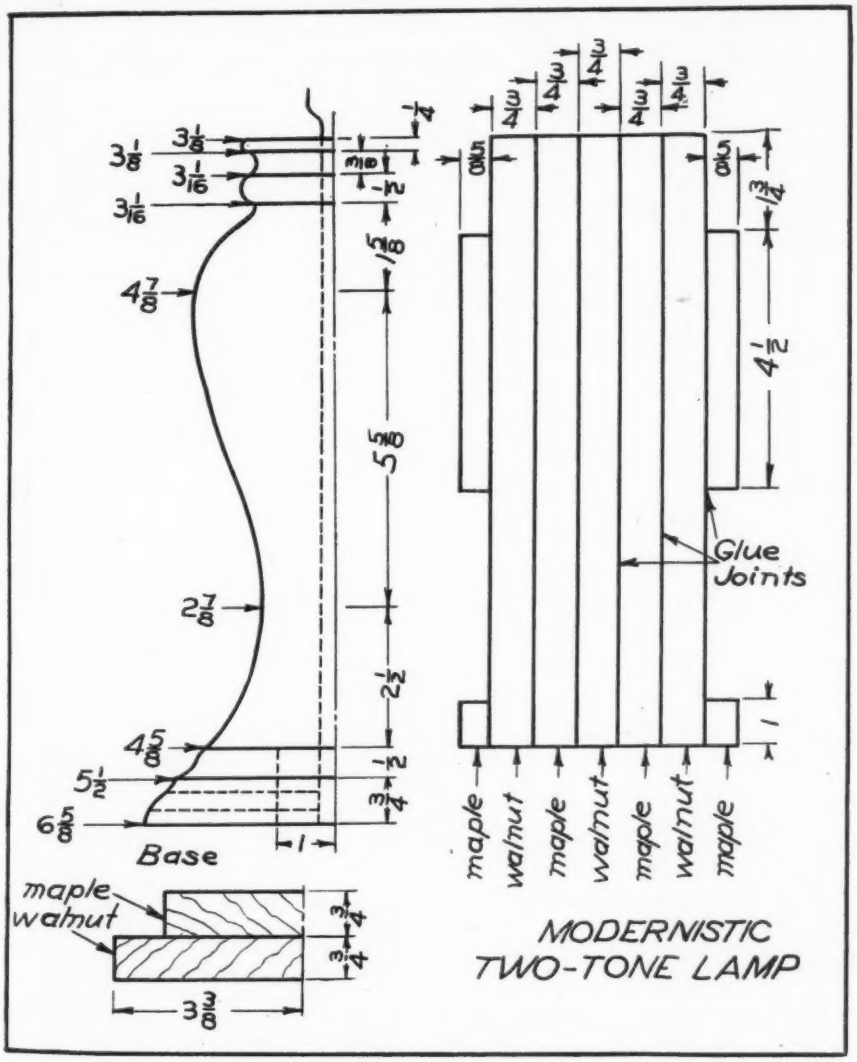


Fig. 2. Details of two-tone lamp base

FARM SCOOP

Robert H. Smith
New York State School of Agriculture
Canton, N. Y.

One of the farm shop teacher's objectives is to train the boys to make best use of the tools that they have at home. Consequently he is constantly on the alert for practical devices that can be made at low cost with simple equipment.

The scoop shown meets these requirements and has been used with very satisfactory results, both from the interest and workmanship standpoints, in our farm shop classes. When made according to the pattern shown, it is a comparatively simple project but it can be easily made more difficult by requiring the student to develop his own pattern, making a scoop of a different capacity. The one shown holds approximately two quarts of dry grain.

Construction

1. On a sheet of drawing paper of suitable size lay out a rectangle 9 by 17 in., and divide it into 1-in. squares.

2. Sketch in one half of the curved outline of the pattern, fold the pattern vertically through the center and cut it out along the line just drawn. This assures a symmetrical pattern.

3. Transfer the completed pattern to a sheet of 26- or 28-gauge galvanized iron and cut it out with snips.

4. Gauge on lines at the points indicated by the short dash lines of the pattern, and fold as directed by gripping the metal between two straightedged pieces of hardwood which are clamped in the vise. The hem along the bottom is flattened down on the inside surface of the scoop. The two laps comprising the seam should have pieces of cardboard placed beneath them as they are folded down to provide room for interlocking them easily when the scoop is assembled.

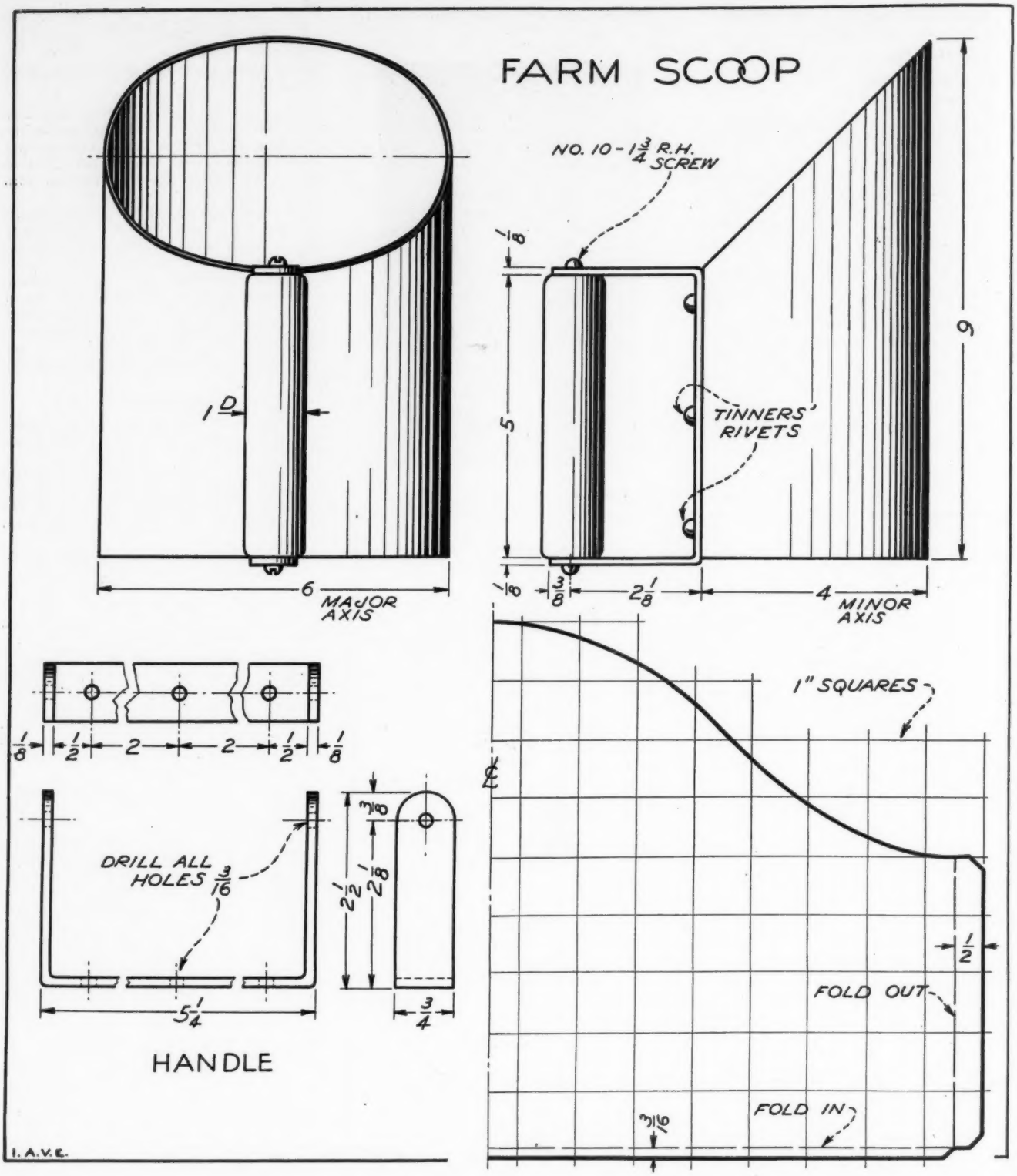
5. Shape the scoop by bending it over a piece of 1½-in. pipe held in the vise, lock the seam, tighten it down and solder inside and out. Hold wet waste or cloth on the inside while soldering the outside to prevent melting the solder first placed on the inside. To assure a good job clean the work thoroughly by scraping, apply a suitable flux, see that the soldering copper is clean and well tinned. Heat it so it will melt solder freely and hold it in contact with the work long enough to bring the temperature of the metal up to the melting point of the solder used. These precautions will make a smooth, sound job.

6. Lay out the handle as shown in the sketch, grind or drill the ends to a ⅜ in. radius, drill and then bend cold in the vise.

7. Place the handle centrally on the seam of the scoop and mark the position of holes for attaching handle. Drill or punch holes in scoop, insert handle in position *inside of scoop*, and rivet in place with tinner's rivets.

8. Fit the bottom to the inside of the scoop, insert it in place against the top edge of the bottom hem and solder around the inside. The outside can be soldered by using wet cloth as when soldering the seam.

9. Cut and drill wood handle and fasten it in place with roundhead wood screws as shown. The handle may be made from a section of hardwood broomstick or if a lathe is available a more ornamental handle may be turned to fit the hand. Finish by painting the handle red or other bright color if desired.



MOTORS FOR SMALL-POWER APPLICATIONS

C. S. Siskind

Purdue University
Lafayette, Ind.

Electric motors are used so extensively and for such a large variety of applications that most of us take them as a matter of course. We hardly realize that practically the entire evolution of the modern motor has taken place since the turn of the present century. Many outstanding men have, of course, been responsible for the extraordinary development of this greatest of servants, but let us not forget that the fundamental principle of the motor was given to us by that most brilliant of pioneers, Michael Faraday, in 1831. The motor is based upon the simple principle that a current of electricity sent through a wire occupying a position near a magnet, will *tend* to make that wire move. In many types of actual electric motors a considerable number of copper wires are wound upon a cylindrical laminated iron frame, called an armature, which is free to turn. Through the wires is

passed an electric current. Surrounding this armature is a combination of electromagnets. It should be remembered that, regardless of the size of the motor, whether it is one of 5000 h.p. capacity to drive the rolls in a steel mill, or one of a fraction of one h.p. used to operate a sewing machine or a drink mixer at a soda fountain, the principle governing its operation is always the same.

This discussion will be limited to very small motors, i.e., those having capacities of less than one h.p., commonly called fractional h.p. motors. There are a good many types of such machines, each having some characteristics which makes it the desirable choice in a given installation. Some are relatively cheap while others are rather expensive. One type draws a considerable current when it starts and can start only a relatively light load. Another type is capable of starting an unusually heavy load while drawing very little current in doing so. Still another type runs at absolutely constant speed regardless of the opposing force to stop it, whereas its opposite will run at speeds ranging from perhaps a few hundred revolutions per minute up to 15,000 or more, depending upon the load it carries. Some motors can operate only in clean, dust-free, moisture-free locations, whereas others may run in places where the atmosphere is charged with acid fumes or explosive mixtures, or even under water. Therefore, an intelligent choice of the proper type of motor to be used in a given installation requires some understanding of both the requirements and of the motor characteristics.

In the fractional h.p. range, which, by the way, represents the largest percentage of the motor installations today, there are at least 15 separate and distinct types. And, as was pointed out, each has some special features which makes it much more desirable for operation under certain conditions.

Let us suppose that it is *your* duty to select a proper motor to operate some mechanical machine. Just what factors would it be necessary for you to consider if your judgment is to be a capable one? In the first place you will have to start *at* the driven machine where information must be secured regarding the nature of the load. What power supply is available? Single-Phase, 60-cycle, alternating current is common, although in a great many cases motors must be capable of operating on either a.c. or d.c. This is true of drink mixers, sewing-machine motors, vacuum cleaners, hair dryers, and the like. Then it will be necessary to determine how large the motor must be. If the motor selected is too small and does not permit of operation through its entire duty cycle it will overheat dangerously and burn out prematurely. If, on the other hand, the motor is entirely too large for the machine which it is to operate, then the efficiency of the installation will be unusually low, both from the standpoint of the first cost and the cost of operation. True, it is sometimes quite difficult to determine the exact h.p. required, but where such conditions arise it is best to do a little experimenting or investigating before making the final selection. An excellent suggestion is to search for a somewhat similar application and to decide upon that basis. Then again, it will be necessary for you to determine how fast, in revolutions per minute (r.p.m.), the motor is to turn. In a very large majority of cases 1800 r.p.m. is common, although speeds of 3600 and 1200 are frequently desirable. What may be even more important than the speed itself is the question of speed range, or, as engineers term it, speed regulation. Except for a special type of a.c. motor, called a synchronous motor, all other types change their speed when the applied load changes. An 1800 r.p.m. motor does *not* run at this speed constantly; in fact, it may run at 1700 r.p.m. when carrying normal load and at 1790 r.p.m. when running light. Other types of motors may have a speed range from about 1000 r.p.m. to perhaps 10,000 r.p.m. or more.

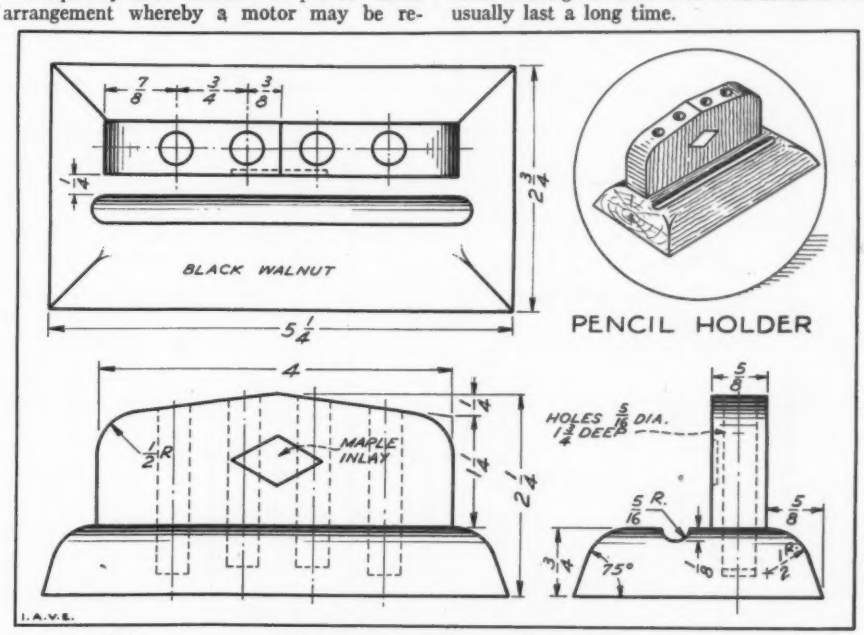
Frequently when using series motors it is desirable to maintain a very narrow speed range, say within 5 r.p.m., that is to say a speed between 1730 and 1735, or between 805 and 810. In such cases it may be profitable to equip the motor with a mechanical governor which is mounted on the end of the shaft and may be adjusted quite accurately for given desirable constant speeds. Where very low speeds are required it sometimes becomes more practicable to use mechanical speed reducers, rather than motors which, themselves, operate at reduced speeds. In this connection it should be emphasized that slow-speed motors of given h.p. ratings are always larger, i.e., bulkier and more costly than high-speed motors. The power hand drill is an excellent example of this fact; here considerable power, and lightweight are important for very obvious reasons. The motor in this case operates at a very high speed, but the drill speed is reduced by a system of gears mounted inside the housing.

Another factor which must be considered is that pertaining to the *starting load* requirements. Engineers refer to this by talking about starting torque. Some types of motors will barely start a light load while others will exert considerable torque as soon as the switch is closed. It should be clear that motors which will bring a heavy load up to speed quickly and without fuss are more costly than those likely to stall. In many installations, however, load is not applied until the motor has reached its normal speed, and under such conditions will continue to operate quite as satisfactorily as those machines capable of performing well during the starting period.

Frequently it is desirable to provide some arrangement whereby a motor may be reversed. Where this is a requirement of the application, it is usually a simple matter to provide a switch, properly wired between the motor and the source of supply, to perform this function. In order that this may be accomplished, however, it is necessary that four leads be brought out from the inside of the motor. If all internal connections are soldered and only two wires come out through the housing, it becomes necessary to open up the motor, unsolder certain connections, and bring the proper ends out to the switch mentioned before. *No motor* can be reversed by simply interchanging the two line leads connected to the motor. Uninformed people have tried this so many times, and have always been disappointed.

One of the most common types of fractional h.p. motors is the so-called split-phase machine. It is built for operation on single-phase a.c. supply only, and runs at fairly constant speed. This motor is cheap, but has certain undesirable characteristics, such as low starting torque, high starting current, and unusually poor power factor. These are used in refrigerators, washing machines, small pumps, grinding wheels, and the like. Recently manufacturers of such motors have improved the design of condensers, commonly called capacitors. These, when used in conjunction with the split-phase motor have brought it up to the standard of their more costly *cousins*, the repulsion type. For a ¼ h.p. motor a condenser of approximately 100 microfarads on 110-volt circuits is employed. The capacitor is mounted directly above the motor or in its base, while one ingenious arrangement is to locate it in one of the end-bell brackets out of reach of tampering hands. Motors equipped in this manner have larger ratings per pound of material and considerably better power factors.

Fractional h.p. motors are so important in performing many duties in the daily lives of millions of people that manufacturers spend enormous sums trying to improve their design to make them trouble free. So, when using electric motors it is always well to follow operating instructions closely. A motor of modern design treated with consideration will usually last a long time.



See description on next page

PENCIL HOLDER

Paul Cressman, Jr.

State Teachers College
California, Pa.

It is always difficult for the instructor in industrial arts to find a project which is interesting and simple enough in design for the student who has never had any woodworking. If the instructor is to get the most out of his boys he must create for them an interest in the subject. The simple pencil holder shown on page 35 is suited for a first project because of its simplicity and unique design.

The value of having the student design his own work is being realized more and more by the progressive industrial-arts instructor. All dimensions are given as a guide but it is not necessary to follow them. There is no limit to the changes possible in this basic design. This pencil holder was constructed from black walnut with a maple inlay which makes a very pleasing contrast.

A CHILD'S STOOL

Hazel F. Showalter,

Davenport, Neb.

The stout little stool shown in Figure 1 is a handy seat for a small child, but father may borrow it to rest his tired feet in the evening and mother may stand on it to reach that inaccessible shelf.

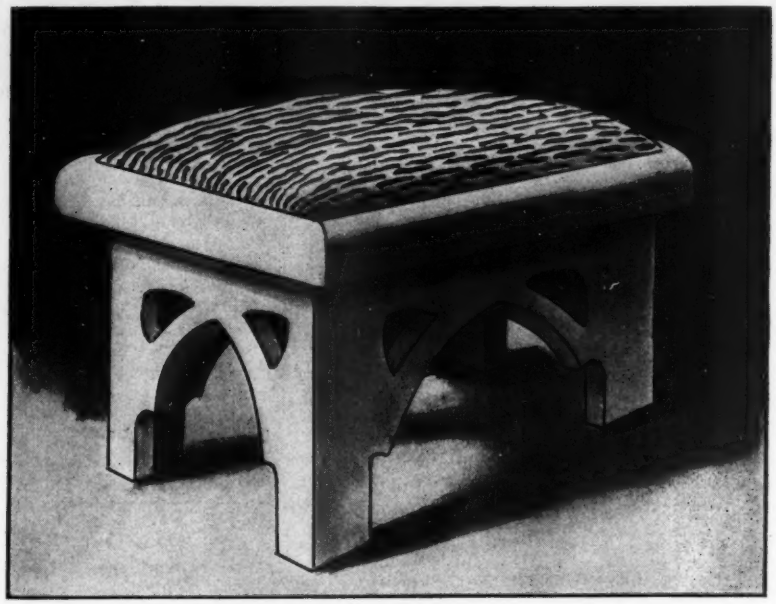


Fig. 1. Child's stool

The sides and the rim of the stool are of 1-in. white pine, the two tops of ½ in., these latter being cut to accommodate the exact thickness of the so-called 1-in. material. When the four sides of the stool have been put together, the lower of the two top pieces,

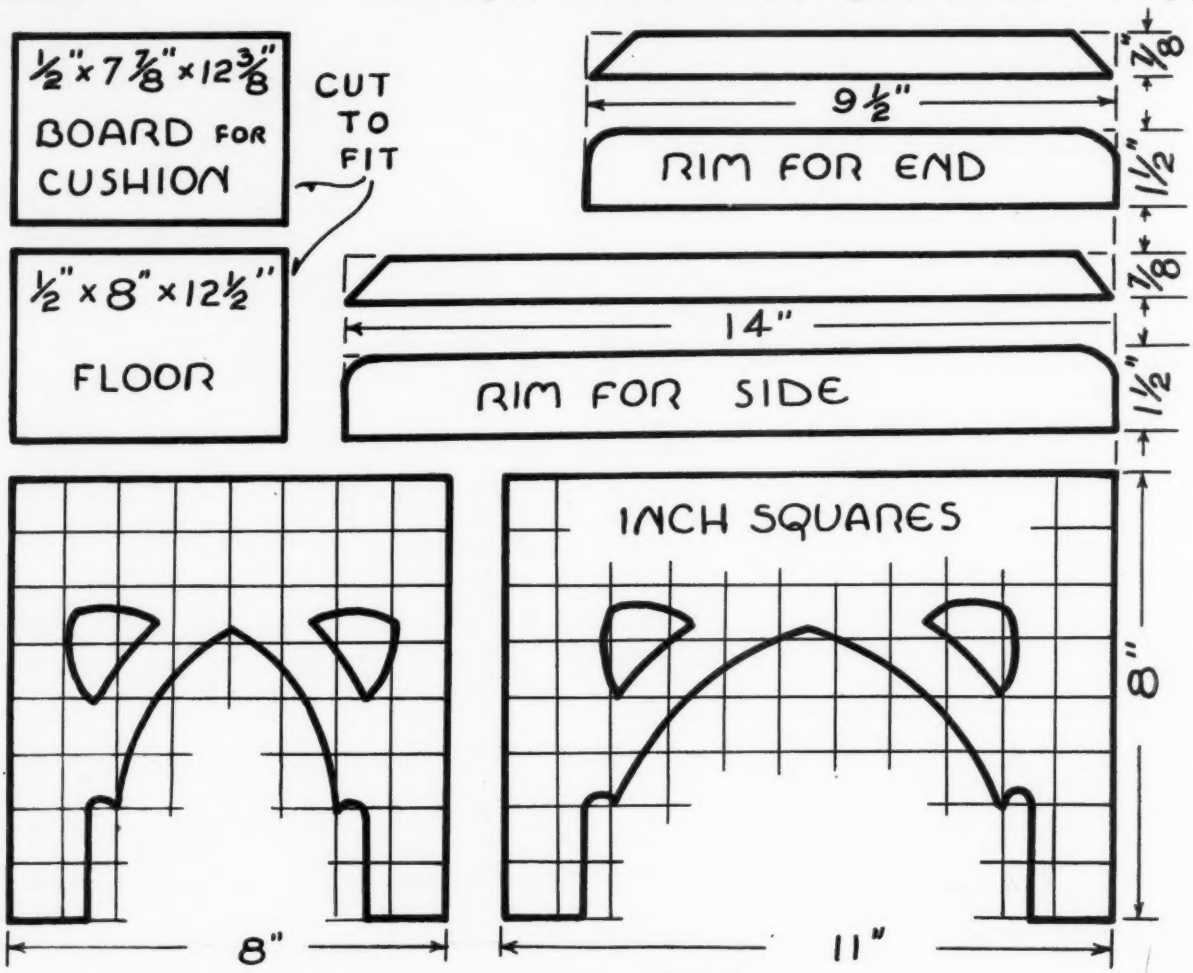


Fig. 2. Details of child's stool

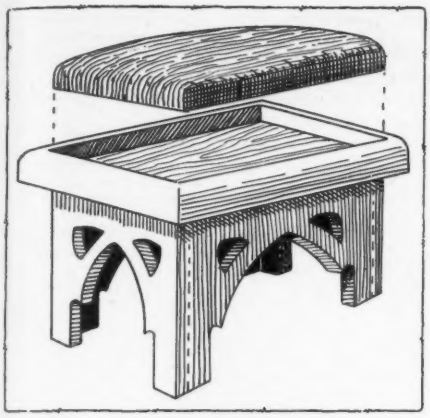


Fig. 3. Assembling the parts

called the floor in the diagram, should just fit over the top of them flush with the edge, as shown in Figure 3, and should be nailed firmly to them.

When the rim is in place around the floor and the top of the stool, as shown in Figures 3 and 4, the board for the cushion should fit inside it loosely enough to allow room for the cloth covering. The board is first padded on top and then the cloth is put over it and the edges tacked to the underside. It is not fastened permanently in place but may be pried out for re-covering.

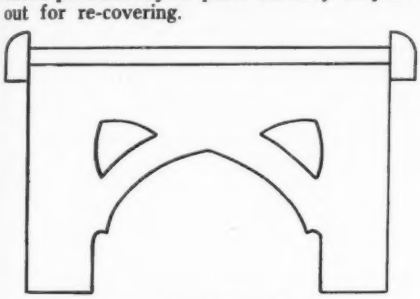


Fig. 4. Attaching the rim

INNER-TUBE TOWEL HOLDER

Robert Owen
High School
New Haven, Mich.

The novel towel holder, shown in Figure 1, provides an incentive to hang up the towel after it has been used.

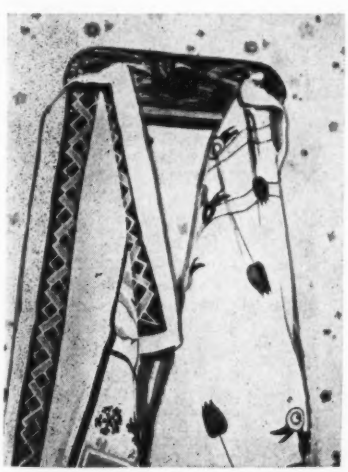


Fig. 1. Inner-tube towel holder

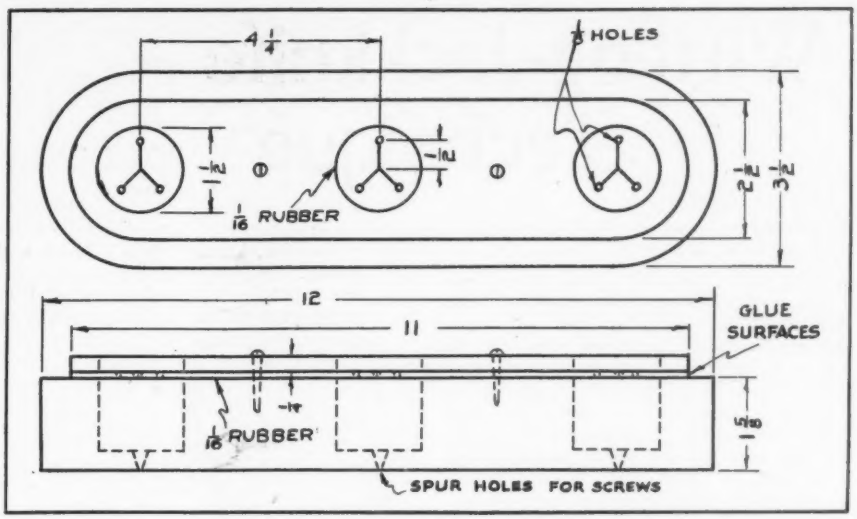


Fig. 2. Details of inner-tube towel holder

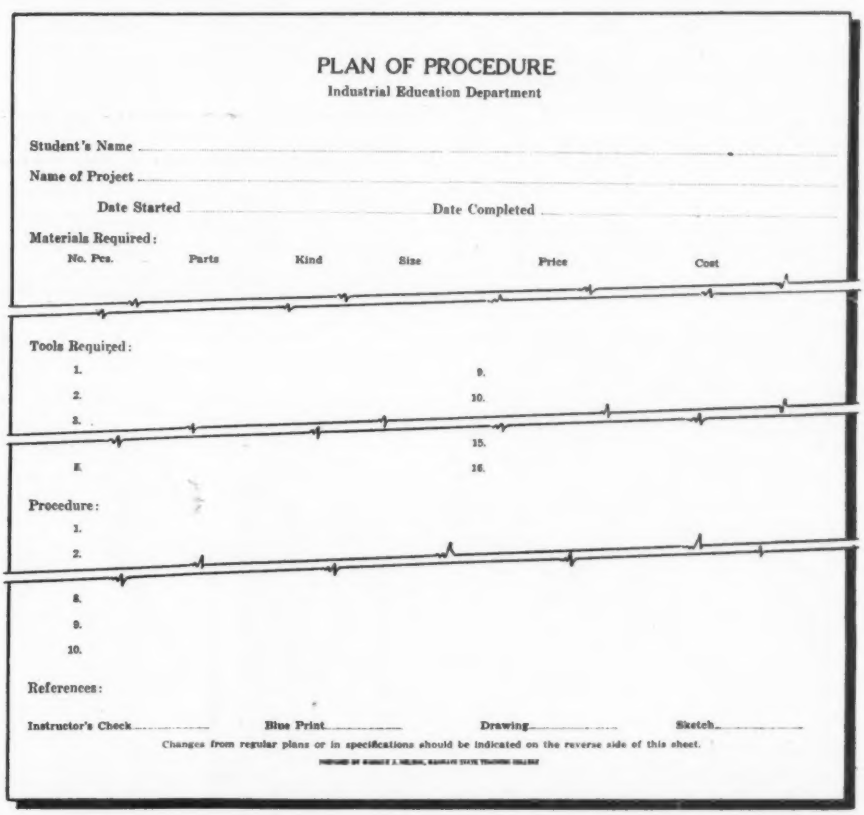
The holder is designed to hold lighter material such as dish towels but the size of the slots and the thickness of the rubber may be increased, if necessary, to hold the heavier bath towels.

The project, details of which are shown in Figure 2, may be constructed from scrap 2 by 4-in. material, and an old inner tube. The face piece is made of ¼-in. plywood. The material cost for this project will not exceed 10 cents.

To lay out the contours on the rubber, place the rubber under the face piece and trace around it with a fountain pen. The small holes are best made with a leather punch. However, if one is not available, the holes may be drilled, but the drilling operation should proceed slowly and with very little pressure. A razor blade will serve for cutting the slits from the small holes to the centers.

Fasten the towel holder to the wall with screws put through the spur holes left by the expansion bit.

Either stain or a two-toned color combination will make an attractive finish.



PLAN OF PROCEDURE

Industrial Education Department

Student's Name .....

Name of Project .....

Date Started ..... Date Completed .....

Materials Required:

No. Pcs. | Parts | Kind | Size | Price | Cost

Tools Required:

1. 2. 3. 8. 9. 10. 15. 16.

Procedure:

1. 2. 8. 9. 10.

References:

Instructor's Check ..... Blue Print ..... Drawing ..... Sketch .....

Changes from regular plans or in specifications should be indicated on the reverse side of this sheet.

Plan of procedure blank designed by Maurice J. Nelson, State Teacher's College, Mankato, Minn. Original blank 8½ by 11 in.

Wittling-Jackknife Technique

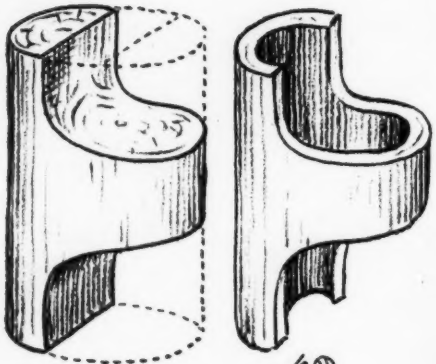
W. BEN HUNT

(*Continued from page 441 of the December, 1941, issue*)

"What shall I whittle?" That is probably the question that most beginners in whittling ask themselves. It is well to start with something rather small, something that can be made in a short while. A neckerchief slide for instance, will be found very interesting. Almost any design may be used. While some of the designs shown may require a little ingenuity, the beginner should not be afraid to try them. The wood costs practically nothing, and the results are usually quite gratifying.

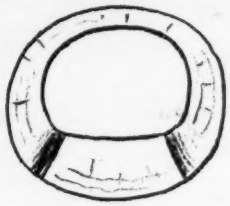
40

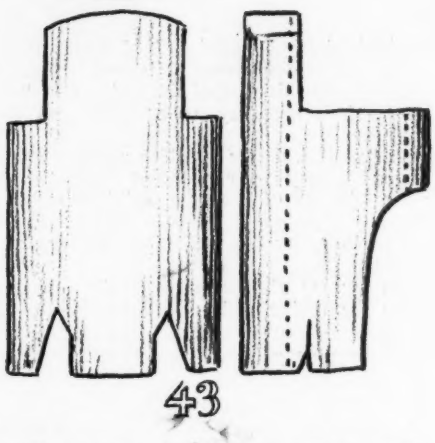
White pine or basswood is the easiest to whittle. Basswood saplings, partially seasoned, cannot be beat for this work. The whittling knife should be razor sharp. This prevents slipping and insures a neat job. Besides this, a really sharp blade enables one to do quite a bit of cross-grain and angle cutting, and only a very sharp knife will do this kind of cutting successfully. Most of the work on these small objects is done with the small blade.



41 42

The simplest kind of slide is one with a monogram or symbol incised or raised on the face of it. Figure 40 shows such a slide. The one shown may be whittled out of a piece of 1⅛ or 1¼-in. sapling (when peeled), or any softwood of that diameter. First rough out as shown in Figure 41. Then cut out the opening for the slide, leaving about a ⅜-in. wall for the ring. See Figure 42. Lay out the design with a pencil and cut down about 1/16 in. Pick out the waste. Initials, monograms,



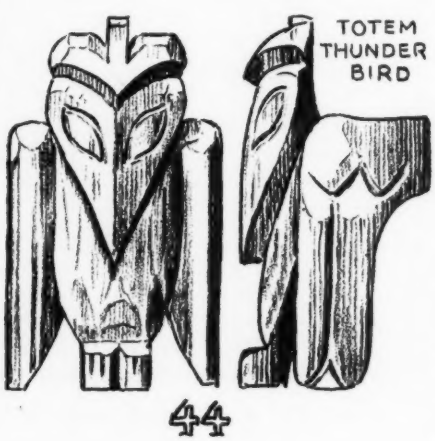


43

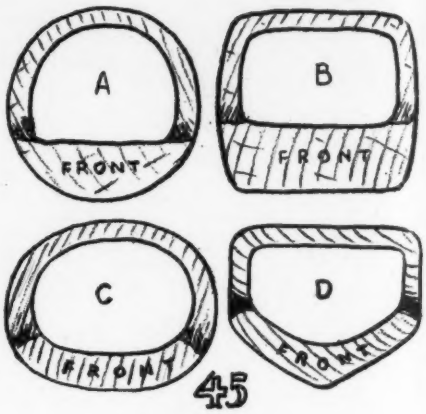
symbols, and other designs may be easily whittled in this flat relief style.

To make something more interesting, try some of the other neckerchief slides shown. All of the sketches are full size, and measurements can be taken directly from them. Proportions, of course, vary, although the opening in the ring should be large enough to accommodate the neckerchief ends. If the hole is too large, the slide may slip off too easily and be lost. If, on the other hand, the hole is too small, the ring is very likely to split.

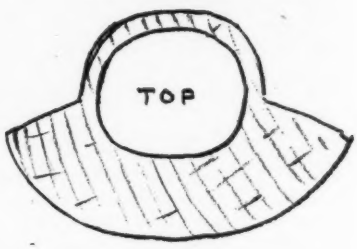
The hole in the ring, or rather the ring

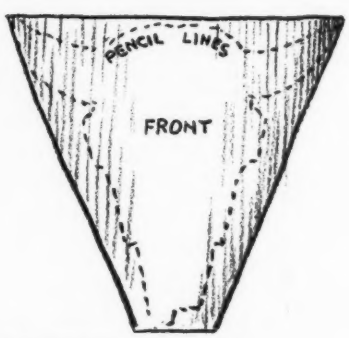


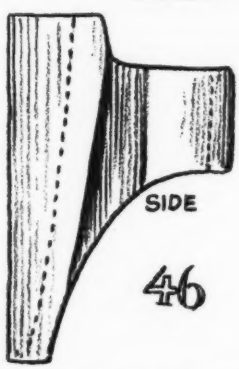
44



45







46

proper, need not necessarily be round. Various types of shapes are shown at *A*, *B*, *C*, and *D*, in Figure 45. The ones shown at *A* and *B* leave the part for the front in one solid piece, while *C* and *D* show the back of the front whittled out also. In the thunderbird, the back of the bird is hollowed out as shown in the top view of Figure 43. After finishing any of these neckerchief slides, they may be painted with water-color paints and protected with a coat of white shellac or varnish, or they may be painted with enamels to suit the owner.

The thunderbird looks better painted than otherwise. Expression can be put in the eyes, and feathers may be painted on the breast.

Figure 44 shows the knife cuts before the final finishing.

The buffalo skull requires a larger piece of wood and the razor-edged blade mentioned before will help a lot in shaping the horns. This slide is easier to make than it seems.

It is always best to whittle out the ring first. Then if it splits, through careless cutting, not so much is lost. The dotted lines in the side view of Figure 46 show how the inside of the skull is hollowed out.

While knife marks are usually left on some good whittling jobs, it is sometimes necessary to sandpaper others. This is the case with the buffalo-skull slide which should be carefully sanded. To make it realistic, paint the horns gray or dark brown and also darken the eye sockets. Then give the whole project a coat of dull varnish.

KINKS FOR THE GENERAL SHOP TEACHER

A. R. Warstler

High School
La Grange, Ind.

A number of ideas and kinks which have proved valuable in conducting my general shop, are listed below.

1. The inexpensive and yet quite serviceable *V* block shown in Figure 1, will be found handy for use in connection with drilling round stock. It may be made of hardwood, such as oak or hickory. A layer of emery paper should be glued to the sides of the *V* cut.

2. Keep an oilcan in a special place on, or near, each machine in the shop. The name of the machine to which it belongs is painted on each oilcan. This saves many steps looking for oilcans, and induces the students to be more ready to lubricate their machines.

3. The hardwood block shown in Figure 2 has its top covered with a sheet of galvanized or black iron. It is a convenient and orderly

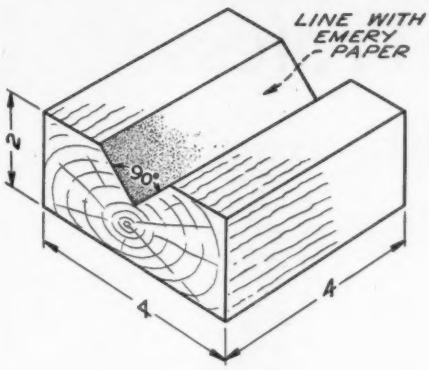


Fig. 1

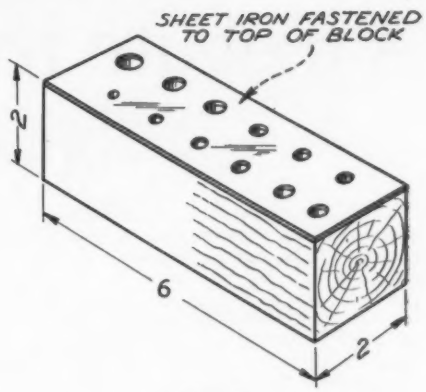


Fig. 2

method of storing drill bits near the drill press, and reduces losses of drill bits.

4. Such tools as wood rasps, files, pipe-threading die stocks, and similar tools which are hard to hang, may be supported on brackets, like the one shown in Figure 3.

Fig. 4

These are made of strap iron and fastened to the tool board in pairs.

5. The skeleton house, shown in Figure 4, is made of 2 by 4's. It is located in one corner of the electrical shop, and provides wiring exercises for the students who have finished making the required hookups on the bench. Each student is required to wire this house, using the regular commercial fixtures and conduit.

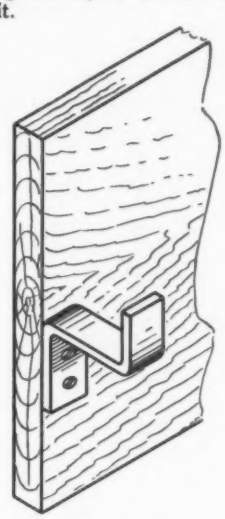
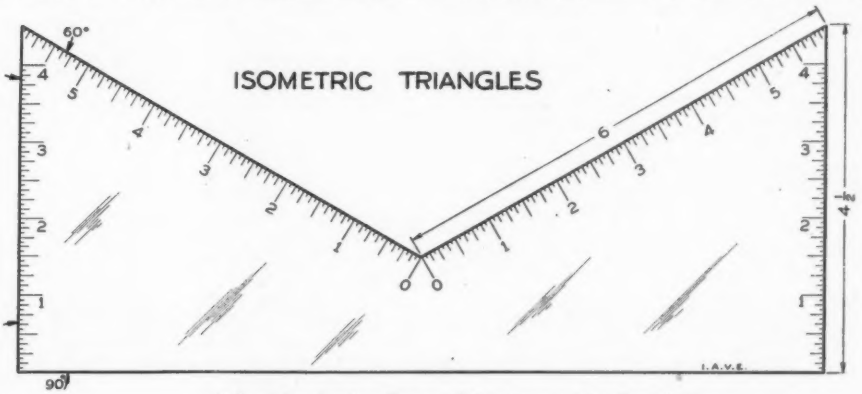


Fig. 3

AN ISOMETRIC TRIANGLE

Kenneth Grinager,
Central Intermediate School,
Honolulu, T. H.

The isometric triangles described herewith have been found exceedingly useful in my drawing classes. The first ones made were cut out of plywood, but it is very much better to make them of celluloid or a similar substance.



A handy device for making isometric drawings

A Tribute to Professor Selvidge*

WILLIAM T. BAWDEN**

Some may think that Professor Selvidge was so widely known that a biographical sketch is superfluous, but I feel impelled to set down here my impressions as I contemplate the loss of a great and beloved leader, a co-worker with whom I have been associated in many undertakings, and a close personal friend for more than 30 years. There is ample reason for hesitation in the preparation of such a statement, for Selvidge's career was so varied and his activities so extended that no one person is capable of filling in an adequate picture.

1. *Personal.* — Professor Selvidge excelled in so many directions that to try to state what was his greatest contribution would only be to invite the assembly of a gallery of pictures taken from different perspectives. The members of the Manual Arts Conference of the Mississippi Valley, I feel safe in saying, will always gratefully remember the charm of his personal qualities, his genial smile and friendly greeting, his keen insight into the problems of the teacher and his generous contribution to their solution, his sterling character and unwavering integrity; and, in these last years, his steadfast courage under adversity, that has been an inspiration to all who knew him. We know that these personal relationships meant a great deal to Selvidge also, for on many occasions he spoke of the "priceless friendships" formed among the members of the conference.

2. *The Conference.* — The Manual Arts Conference of the Mississippi Valley owes its existence to Selvidge's vision of the need of counsel in the solving of new problems and in the formulation of new plans and procedures at a time when we were quite without precedent or tradition to guide us, and to his vision of the possibilities of a new type of informal but intensive and penetrating round-table discussion that seeks to get to the bottom of things, that stimulates every participant to contribute to his best, and that leaves each individual to carry away whatever he is capable of appropriating to his own personal need.

3. *Analysis.* — One of Selvidge's major contributions certainly was his method of analysis applied to the problems of the teaching of shopwork and drafting, whether in general education industrial arts or in vocational industrial education. It is impossible to estimate the extent of the influence of his teaching upon the teaching of shopwork and drafting. His emphasis upon the necessity of discovering or determining "what the learner needs to know and to be able to do" before other steps can be taken has transformed the work of the teacher in other fields as well as ours. His analysis of the various shop subjects into "learning units," and his insistence that every project and every experience should be analyzed to determine just what the learner is expected to learn, have been revolutionary in their contribution to the improvement of teaching.

4. *Objectives.* — Another service of fundamental significance was his formulation of the "objectives of the industrial-arts teacher," a statement that has been more widely quoted and accepted than anything else that has appeared on that subject, either before or since.

5. *American Vocational Association.* — Of inestimable value was Selvidge's guiding hand

Robert Washington Selvidge

in the internal developments, formulation of policies, and establishment of precedents, as vice-president for industrial arts for two terms, during a critical period of transition in the American Vocational Association. Only a limited circle of individuals will ever understand the extent of his accomplishments in this connection, and the modest yet masterful way in which he first commanded the respect of unfriendly elements and then secured a respectful hearing for the cause he represented.

6. *Author.* — Selvidge stands in the very forefront as an author and as one who stimulated others to significant productivity. His *Individual Instruction Sheets,* and *How to Teach a Trade,* have been widely used. The outstanding feature of *Principles of Trade and Industrial Teaching,* in the writing of which he collaborated with Dr. Fryklund, is its practical application of psychology and philosophy to the work of the shop teacher. Eminent educators, including the leading psychologists, have commended this as one of the best books yet written on the psychology of learning. Time would fail to tell of the Selvidge series of "Instruction Manuals," and other publications. We may well be proud that one of our number is responsible for producing such an array of teaching helps.

7. *Educational Journals.* — Selvidge was a regular and able contributor to *Industrial Education* magazine, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine, and other professional journals. Beginning in 1928, he served for six years as associate editor of *Industrial Education* magazine.

8. *United States Army.* — During, and for a short time following the first World War, Selvidge served as district director of vocational training with the Committee on Education and Special Training of the War Plans Division of the United States Army. In this capacity, with the aid of a staff organized for the purpose, he developed a plan for teaching trades in the army cantonments and elsewhere, together with a system of instruction sheets and a series of manuals for the guidance of instructors. Following the Armistice, this work was closed in March, 1919, and the accumulated mass of material was consigned to the archives of the War Department in Washington. During the brief period the plan was in operation, 88,972 mechanics were trained in schools and classes organized under his supervision, and supplied to 14 different services of the army, representing 71 different vocations. If the government had permitted the completion of the manuals, and had made the manuscripts available to the public, the cause of industrial education would have been advanced by at least a decade.

9. *Railroads.* — In June, 1920, Selvidge was released from his duties with the Committee on Education and Special Training, and returned to the University of Missouri. Shortly thereafter, his achievements with the army having come to the attention of certain prominent railroad officials, he again was granted leave of absence to execute a mission for a group of railway presidents, of which Lenore F. Loree, then of the Delaware and Hudson Railroad, was the leader. Selvidge spent considerable time in England and Russia studying problems of personnel training, submitting reports and recommendations of the greatest significance. As a result of his visit to Russia and his conferences with officials there, *Individual Instruction Sheets* was translated into the Russian language and published by the Government Technical Publishers.

*Prepared for the members of the Manual Arts Conference of the Mississippi Valley.

**Director, State Teachers College, Pittsburg, Kans.

Personal News

DR. DALTON APPOINTED TO UNIVERSITY POSITION

Dr. Frank W. Dalton, on October 13, was assigned to the teacher-training staff of the University of Michigan, Ann Arbor, Mich.

Dr. Dalton's experiences, gathered while he

Dr. Frank W. Dalton

was teacher, county superintendent, state apprentice co-ordinator, and chief of the industrial-

(Continued on page 12A)

How Atlas SERVES THE NATION

One in a series of messages showing how Atlas helps in the armament program.

Off. U. S. Navy Photo

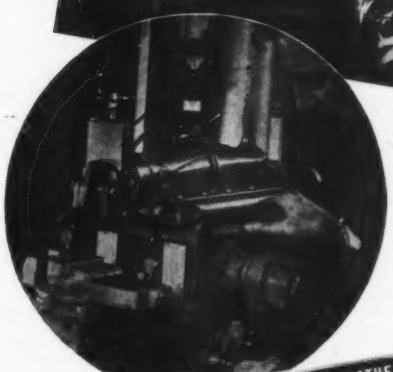
CORNING ANSWERS THE CALL!

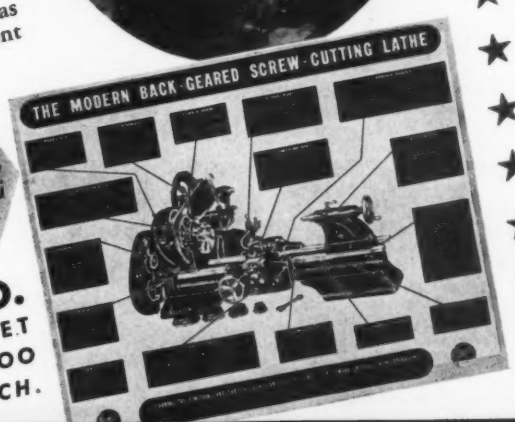
"·—· ··— — —·· ··· ···· · ·— —·· ·— ··· ···· · ·— —··"

Battleship "blinkers", airplane signal lights, beacon lights and air field floodlights — intensified by accurate lenses — are but a few of the important products of the Corning Glass Works that multiply the fighting power of our armed forces.

Hard at work in Corning's famous laboratories for research in Corning, N. Y., scientists seek still more effective uses for glass. And as in so many other key production plants, Atlas precision equipment helps share the burden. Atlas Shapers are used in making new apparatus for these laboratories and in the Mechanical Development Department Atlas Lathes machine many small precision parts.

You can give your defense trainees a head start in industry by equipping with the Atlas Tools they will find on the job in armament production throughout the nation.





NEW This large wall chart explaining functions and care of lathe parts, and three other helpful blue print charts. 15c per set, coin or stamps. Limited supply, write today.

Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH. U. S. A.

ATLAS PRESS CO.
171 N. PITCHER STREET
KALAMAZOO
MICH.

LATHES · DRILL PRESSES · ARBOR PRESSES · SHAPERS · MILLING MACHINES

"He'll be an all 'round welder when HE graduates"

INDUSTRY, today, demands "all round" welding operators—welders who know a-c, d-c, and atomic-hydrogen welding.

Your graduates, if they are trained on all types of welders, will have a head-start when it comes to getting preferential ratings for jobs—because their ability won't be limited to just *one* type of welding.

Used and endorsed for excellent performance and economy by every industry that uses welding, the G-E line of arc welders is the most complete line on the market.

Your nearest G-E arc welding distributor or G-E office is a reliable source of supply for modern welding equipment and for unbiased information on all phases of arc welding technique and procedure. Why not call today? No obligation. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

(Continued from page 40)

education staff, will stand him in good stead in his new position.

His many friends wish him well in this work.

BENJAMIN FREY DIES

Benjamin Frey, an instructor at the Milwaukee Vocational School for 28 years, died November 23, 1941.

He was born at Lodi, Mich. He learned the machinist trade at Jackson, Mich., attended a technical institute in New York City, became an instructor for apprentices for the New York Central, and then joined the faculty of the University of Wisconsin Extension Division as instructor of apprentices in 1911. When this work was taken over by the Milwaukee Vocational School in 1913, he became affiliated with that school.

In his continued efforts at self-improvement he did work at the Milwaukee State Teachers College and also finished all of the courses offered by the teacher-training department of the Milwaukee Vocational School.

He was an earnest, indefatigable worker, an excellent teacher, a friend to each one of his students, and was respected by every teacher on the large staff of the huge school at which he spent so much of his life.

He is survived by his wife, three sons, his mother, and a brother. Burial took place at Jackson, Mich.

His death is a severe loss to everyone who knew this generous, lovable character.

PROFESSOR SELVIDGE PASSES ON

Professor Robert Washington Selvidge, well-known pioneer in the fields of industrial arts and vocational education, died at University Hospital, Columbia, Mo., at 9.50 p.m. Sunday, November 16, 1941.

At the funeral service, the following statement, written by Professor Selvidge shortly before his death, was read. The sentiment which he so beautifully expressed in this farewell message may well serve as a meditation for every teacher of industrial arts and vocational education.

"In the Evening"

"Now that day is drawing to a close and the main work of life is done, I look about me to see the meaning of it all.

"Still graven on my heart is the message of more than fifty years ago, 'Nothing dies. Nothing can die. No idlest word thou speakest but is a seed cast into time to grow throughout eternity.'

Robert Washington Selvidge

"So I, with chosen or with thoughtless words, have changed the lives of men, and they of other men down time's full stretch. Thus shall I live a glorious immortality.

"To you who give this precious gift, greetings and farewell.

"Night approaches!

"'I have finished the work Thou gavest me to do.' To Thee I render back my worn and dinted tools.

"Night is come!

"Enfold me in Thine almighty arms."

Professor Robert W. Selvidge was born August 11, 1872, at Montview, Mo., and spent the major portion of his life in that state. About twelve years ago a physical examination disclosed the existence of an inoperable cancer, which the surgeons said would end his life in two years. He began a course of treatments which held the malady in check until recently. About two years ago a change for the worse took place, and on August 6, 1941, he entered the hospital for the last time.

He is survived by his widow, a daughter, and a son who is a graduate of Massachusetts Institute of Technology in electrical engineering; three grandchildren; two brothers and a sister.

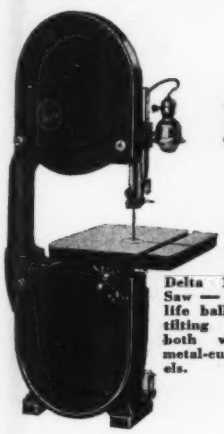
He taught in rural and village schools in Missouri, 1890–95; was county superintendent of schools, Johnson County, Warrensburg, Mo., 1895–97; inaugurated the department of industrial arts in the high school, Joplin, Mo., 1900–03; taught industrial arts, Louisiana Polytechnic Institute, Ruston, 1903–07; organized the department of industrial education at the University of Missouri, Columbia, 1908–13; same, Peabody College, Nashville, Tenn., 1913–19; same University of Missouri, 1919–41. From 1925 to 1935, he served also as chairman of the department of mechanical engineering, and in 1934–35, as acting dean of the College of Engineering, University of Missouri.

During his term of service at Peabody College he was in charge of the building program for which funds were provided by the General Education Board, and supervised the construction of a group of buildings costing over $1,000,000.

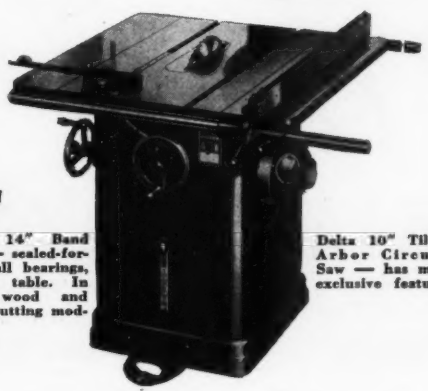
(Continued on page 14A)

How to Plan a School Shop

Delta 12" Lathe—equipped with sealed-for-life bearings, self-indexing headstock — ideal for school shops.



Delta 14" Band Saw — sealed-for-life ball bearings, tilting table. In both wood and metal-cutting models.



Delta 10" Tilting Arbor Circular Saw — has many exclusive features.

Delta 6" Jointer Unit—a compact, well guarded unit with dual control handle, patented fence and other special features.

Delta 17" Drill Press — has numerous special features. A full line of 11" and 14" models also available.

...to meet the needs of Today-and Tomorrow!

Any program for equipping new school shops — or modernizing old shops — must take into consideration the important changes that have taken place in the types of machines and in American industrial shops.

There has been a remarkable trend toward the increased use of low-cost, high quality machines in all branches of U. S. Industry. Tens of thousands of these relatively new types of machines are being widely used for both normal and defense production.

When peaceful days return, the many advantages of these machines — their low cost, flexibility, portability, low maintenance costs, will assure them a permanent place in our industrial economy.

Here is a real opportunity. Now it is possible to equip school shops with the same machines that industry uses today — and will use TOMORROW.

Everyone connected with vocational and industrial education should get the full details of this comparatively new development in the machine tool field.

SEND FOR FREE BOOK

"New Wings for Production" gives you all the facts on one of the most remarkable developments in American industry. It shows you exactly how one industry, aviation, is meeting its greatest crisis by utilizing the new type low-cost machine tools. Actual installation photographs in America's largest aircraft plants are reproduced so that you get the full detailed picture of this important change. Fill out the coupon to the right — today!

DELTA
MILWAUKEE

THE DELTA MFG. CO.
661-A E. Vienna Ave., Milwaukee, Wis.

Please send me a copy of the FREE Booklet "New Wings for Production" and your latest catalog of DELTA-Milwaukee machine tools.

Name .....

School .....

Address .....

"BOY-PROOF" FEATURES MAKE THESE STANLEY HAND DRILLS Ideal For The School Shop

★ Chuck locked on spindle — opens to capacity and stops

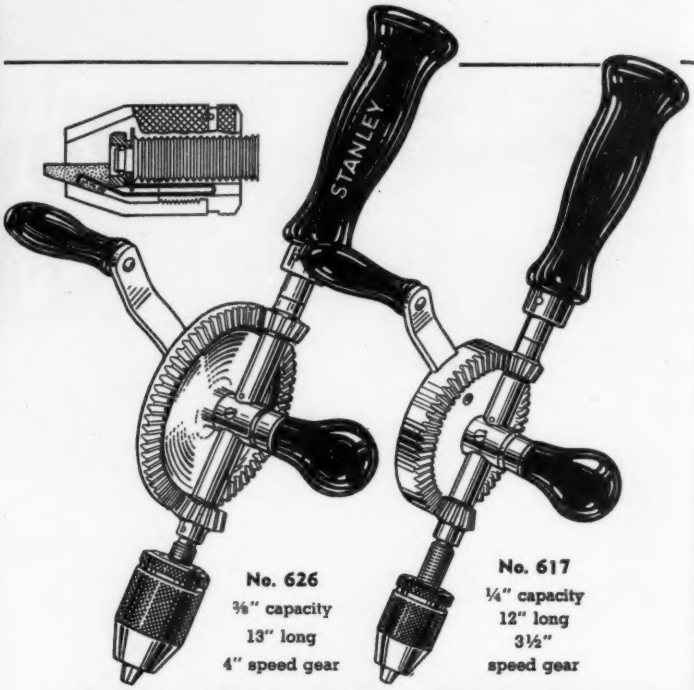
★ Protected jaw springs, hairpin design

★ All steel frame for light weight and strength

★ Machine cut gear and pinion teeth for easy operation

★ Heavy offset crank and full size handle

Built for rugged service in the school shop. Write for Stanley Catalog No. 34 and use it as a handy reference book.



No. 626
⅜" capacity
13" long
4" speed gear

No. 617
¼" capacity
12" long
3½"
speed gear

STANLEY TOOLS
Division of The Stanley Works
Educational Dept., New Britain, Conn.

(Continued from page 12A)

For eight years, beginning in 1933, he served as chairman of the Missouri State Advisory Board for Expenditure of Public Works Funds.

During the first World War he served as district director of vocational training, War Plans Division, War Department, and later as supervisor of instruction and consulting expert on special schools for the training of army personnel.

In May, 1928, he organized the Missouri State Conference on Trade and Industrial Education at the University of Missouri, which meets annually in the spring, and brings together an imposing array of speakers and a large attendance of teachers and supervisors of industrial education and industrial arts, as well as many superintendents, principals, and other administrators.

His professional preparation included two years at the University of Missouri, 1896–98. This was followed by two years in the Spanish-American War, during which time he served as first sergeant, Co. I, 4th Missouri Volunteer Infantry. After his discharge from the army, he enrolled at the State Teachers College, Warrensburg, Mo., and received the B.Pd. degree, 1900. He completed the teacher-training course at Bradley Polytechnic Institute, Peoria, Ill., in 1907; and, after one year of study at Teachers College, Columbia University, New York, received both the B.S. and M.A. degrees in 1908.

He was an active member of the National Education Association, American Association of University Professors, Society of College Teachers of Education, Mechanical Engineers, Society for the Promotion of Engineering Education, American Association of Adult Education, American Vocational Association (vice-president for Industrial Arts, 1933–39), Missouri Vocational Association (vice-president, member of executive committee), American Association for the Advancement of Science; American Academy of Political and Social Science, Western Arts Association (president, 1914), Phi Delta Kappa.

—William T. Bawden

♦ W. B. SKELTON, social science and economic instructor of Concordia, Kans., has been appointed local director of the evening program in that city.

♦ WILLIAM G. MCGARVEY, formerly of Collegeville, Pa., and an instructor in the Brown Vocational School at Wilmington, Del., has accepted a position as instructor in the Transportation Laboratory at Oswego State Normal School. Work in this department will include a study of all common transportation facilities and their relation to modern society.

♦ ERNEST W. LARSON, teacher of physics, chemistry, and social science of the Community High School at Clay Center, Kans., has been appointed as local director of the evening program.

Questions and Answers

CHANGE A DARK OAK FINISH TO BLEND WITH MODERN "BLONDE" FINISHES

1081. Q.: I have an oak desk that has a dark finish and I wish to refinish it so it will blend in with the "blonde" or "toast" mahogany furniture.

Could you tell me the proper procedure to use to clean the old finish off, and how to refinish to obtain the desired result? — *H. M. M.*

A.: Strip the entire job with shellac-mixing grade of denatured alcohol rather than varnish remover, in order to avoid all traces of wax. Cover a square foot of surface with the alcohol, repeat with another area, come back to the first and cut off the old finish with No. 2 steel-wool pads. Clean off loose material with burlap squares. Scrub again with alcohol and wipe clean. Pick all corners and molding lines with a clean rag and picking stick which can be made from a ½-in. birch dowel 6 in. long, sharpened to a pencil point on one end and a skew chisel on the other. Continue until the entire job is cut to clean wood.

Let dry overnight, then sand to bright wood with suitable sizes of garnet finishing papers. Do not attempt to do this work with flint papers as the grit is altogether too dull to do this class of work. If the job has been filled with a silex base filler you are in for a lot of grief, and in this case I frankly advise you not to start the job at all with the idea of getting a blond finish over dark-filled pores which are a practical impossibility to clean out and cannot be bleached.

For your bleaching material I suggest that you write to Kenneth O'Meara, Kenwood Brands Laboratory, Ashville, N. C., who will sell you the quart sizes of the two materials necessary for the work. Be most careful to use rubber gloves and protect your eyes constantly while doing this work. Follow directions!

Use lacquer for the final finish. — *Ralph Waring.*

Association News

♦ The Industrial-Arts Section of the Northern Kentucky Education Association held its annual meeting at Holmes High School in Covington, Ky., on Friday, November 7, 1941. Mr. Marshall Hurst, industrial-arts instructor in the high school, Newport, Ky., was the presiding officer.

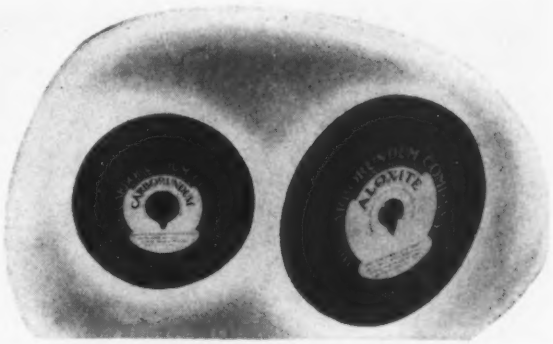
An exhibit of work of the industrial-arts shops of Northern Kentucky was on display. The five hundred items exhibited represented work in wood, metal, leather, art, mechanical drawing, plastics, fiber weaving, loom weaving, electricity, radio, chair caning, model airplanes, model trains, welding, linoleum block printing, and printing. Students from the Holmes Industrial-Arts Shops acted as guides.

The speaker of the meeting was Dr. John A.

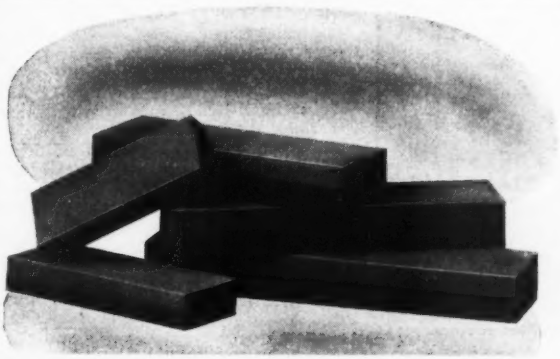
(Continued on page 16A)

Students get the professional touch with

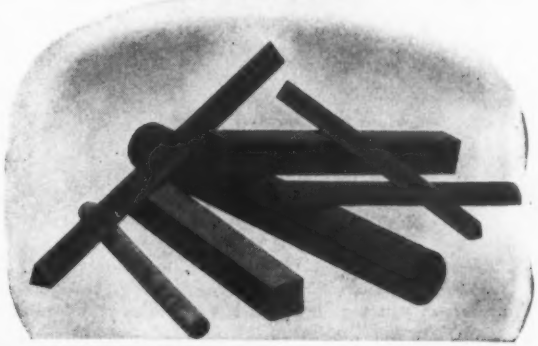
CARBORUNDUM BRAND PRODUCTS



GENERAL PURPOSE WHEELS. Today in industry these grinding wheels by Carborundum are playing a more important part than ever before. In the classroom they are effectively used for grinding lathe and plane tools, cold chisels, drills etc. Their use will enable your classes to do faster and better work.

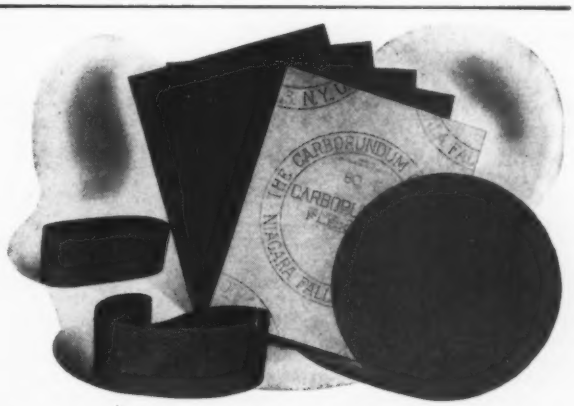


SHARPENING STONES. A good workman or student always keeps his tools sharp. And the art of sharpening is much easier to teach if you use fast cutting stones like these. Write today for catalog.



MACHINISTS' STICKS. These are the toolroom sticks and stones which machinists use to put the finishing touches on tools and dies. When you use Carborundum Brand in your shop work, you use the same kind mechanics have long preferred.

METAL FINISHING CLOTH. In modern machine shops an endless number of jobs are being done with Aloxite Brand Aluminum Oxide Coated Abrasives. Indispensable for metal finishing, removing rust, fitting metal parts, cleaning up for brazing.



COATED ABRASIVES FOR WOODWORKING. Hundreds of woodworking plants have discovered there are coated abrasives that produce smooth finishes and make short work of tough jobs like removing excess glue. Try Aloxite Brand Aluminum Oxide Electrocoated "K5"-R or Garnet Paper, in sheets, belts or discs.

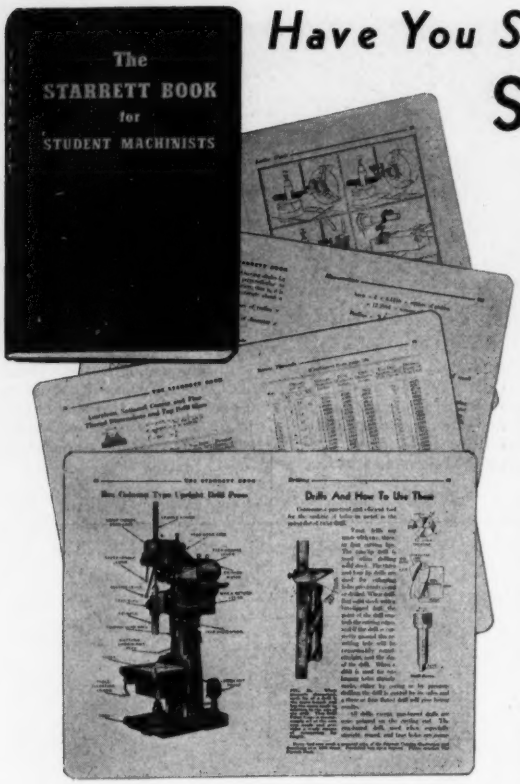
CARBORUNDUM ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N.Y.

REG. U. S. PAT. OFF.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company)



Have You Seen This NEW

STARRETT BOOK?

Partial List of Contents

How to Read Working Drawings
Measuring Practices
Precision Tools
How to Read a Micrometer
How to Read a Vernier
Facts about Fits
Limits of Tolerance
Bench Work
Chipping and Filing
Metal Cutting
Drilling
Lathe Work
Screw Threads
Tapers
Tool-Making
Jigs and Fixtures
Grinding
Setting Up Machinery
Mensuration
Mechanics

184 PAGES
Over 200 DIAGRAMS and ILLUSTRATIONS
30 REFERENCE TABLES

Let this new Starrett Book help you ground your students in the fundamentals of modern metal working shop practice. It's an up-to-the-minute manual and ready-reference handbook prepared in cooperation with leading vocational training instructors. Combines the best features of the popular Starrett Book for Machinist's Apprentices (Vol. I) and the Starrett Machinists' Data Book (Vol. II), completely revised, brought up to date and bound in a single volume which sells for the price of one of the two previous books.

Printed on high grade paper and bound in sturdy, soil-resisting Terek Cloth, the new Starrett Book for Student Machinists is available through distributors of Starrett Tools at only seventy-five cents per copy.

THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U. S. A.

World's Greatest Toolmakers

STARRETT TOOLS

Precision Tools . Dial Indicators . Ground Flat Stock . Hacksaws . Metal Cutting Bandsaws . Steel Tapes

(Continued from page 14A)

Whitsell of the Industrial-Arts Department of Miami University, Oxford, Ohio. His subject was "The Industrial-Arts Profession Faces 1942."

Mr. Elmer Christy, Supervisor of Industrial Arts, Cincinnati, Ohio, urged greater cooperation between the individual industrial-arts teachers, and earnestly suggested a broadening of the industrial-arts program so that the students would become better acquainted with the materials used by industry.

It was moved that the Northern Kentucky Section should apply for affiliation with the American Industrial-Arts Association.

The following officers were elected for the coming year: president, William Fitzgerald, Holmes High School, Covington, Ky.; vice-president, Thomas Lovette, Ludlow High School, Ludlow, Ky.; secretary-treasurer, Charles T. Lucas, Dayton High School, Dayton, Ky.

The next meeting will be held at the Dixie Heights School, Covington, Ky., on December 3.

—*William Fitzgerald.*

♦ The Industrial-Arts Section of the Texas State Teachers Association had an interesting program for the meeting held on Friday, November 21, at Houston, Tex.

The morning meeting began at 9:15.

Glenn Fletcher, principal, Houston Vocational School, spoke on the subject of "Vocational Guidance in the Secondary Schools." Victor J. Smith, professor of industrial-arts education, Sul Ross State Teachers College, Alpine, Tex., discussed "Common Sense in Our National Defense Program." J. F. Stanley, Paris, Tex., had chosen "Costume Jewelry and Art Metal" for his subject. An industrial-arts luncheon was held at 12:00.

At the afternoon session, the speakers were Herbert Huffaker, Stephen F. Austin Junior High School, Galveston, Tex.; H. D. Peavey, Beaumont, Tex.; and C. A. Hall, director of Hughes Industrial School, Houston, Tex. The subjects discussed were "Printing in the Junior High School," "Have We Met the Callenge?" and "Teaching of Industrial Mathematics."

♦ The first meeting of Worcester Industrial-Arts Instruction Club met at Pocomoke, Md., Saturday, November 15, 1941, at 11 a.m.

The meeting was devoted to discussion of administrative problems of the general shops. Preparations for programs for the coming year were also discussed.

The members are Gerhart Neubauer, Pocomoke; Gorden Patten, Ocean City; Robert Johnson, Snow Hill; and John T. Bruehl, Jr., Berlin.

The next meeting will be devoted to grades and grading.

—*John T. Bruehl, Jr.*

♦ The fall meeting of the Southern Section of the California Industrial-Education Association was held at Glendale, Calif., on Saturday, November 8, 1941.

The business session started at 9:30 a.m. The regular meeting was held at 10 o'clock, and a luncheon at the Glendale High School cafeteria concluded the program.

♦ The annual meeting of the Wisconsin Industrial Arts Association was held in the auditorium of Marquette University, Milwaukee, Wis., on Thursday, November 6, 1941, at 2:00 p.m.

R. R. Bedker, Wauwatosa, the president of the Wisconsin Industrial Arts Association, presided.

Dr. William F. Rasche, director, Milwaukee Vocational School, spoke on the subject of "Responsibilities for Vitalizing Elementary and Secondary Education Through the Practical Arts."

He was followed by Harvard Smith, Central High School, Kenosha, Wis., who discussed "The Teacher's Responsibility."

H. B. Nash, Superintendent of Schools, West Allis, Wis., then spoke on "The Administrator's Responsibility," and Frank V. Powell, Assistant State Superintendent, Madison, Wis., pointed out the "State's Responsibilities."

Dean Clyde A. Bowman, The Stout Institute, Menomonie, Wis., gave a report of the year's activity of the state curriculum committee, and presented the latest bulletin, "Source-Material Guides for Course of Study Planning in Drawing," which has just been prepared by the committee.

Group meetings on printing, one-man shops, mechanical drawing, general metal, and woodworking, were held Friday afternoon.

The following were elected officers for the coming year: O. L. Wakeman, Fond du Lac, president; Leslie W. Brown, Delavan, vice-president; Victor E. Thompson, Stevens Point, committeeman; H. J. Shufelt, Racine, secretary-treasurer for three years.

♦ The October meeting of the Westchester Industrial Arts Club was held on the evening of October 30, at the Bellows High School, Mamaroneck, N. Y.

Early in the evening the members had an opportunity to see a newly decorated shop done in bright colors under the direction of Mr. Herbert Lidstrom. Many favorable comments were heard.

Previous to the business meeting, Miss Lydia Altschuler, director of the Consumers' Union educational program, gave an interesting talk on "The High Cost of Living."

A group of boys from the machine shop in the Saunders Trade School entertained the Club with a humorous one-act play. The play was given under the direction of Mr. Elliot from the same school.

Following the business meeting Mr. Fales, State Supervisor of Industrial Arts, gave an inspiring lecture on "School-Shop Environment." His lecture was illustrated by fourteen excellent colored photographs of a school shop in the vicinity of Albany.

—*Norman C. Ferguson*

♦ The Wisconsin Association for Vocational and Adult Education met at the Empire Room, Schroeder Hotel, Milwaukee, Wis., on Thursday, November 6 at 2:00 p.m.

John A. Kubiak, president of the association, was the chairman. Ernest R. Rosse, Philadelphia, spoke on "The Safety Valve of Sanity."

(Continued on the following page)

(Continued from the previous page)

This meeting had been preceded by a luncheon at 12 o'clock.

Friday, November 7, at 2:00 p.m., a meeting on adult education was held at the Vocational School.

A. C. Larsen, Sheboygan, presided. The speakers on the symposium, "What Constitutes an Adequate Program of Vocational and Adult Education," were: Carl Bertram, Appleton Vocational School; Emma H. Toule, Green Bay Vocational School; and H. M. Genskow, Shorewood Vocational School.

♦ The November meeting of the Westchester Industrial Arts Club was held Nov. 28 at the Edison Technical High School, Mt. Vernon, N. Y. Forty eight members were present. A tour of the shops was made while the evening defense classes were in session.

Mr. Robert McDowell reported that the Air Youth of America has been combined with the Boy Scouts of America. A course of study in junior aviation is being prepared for approval by the state education department for use in the junior and senior high schools.

A joint meeting between the Westchester Industrial Arts Club, the Fairfield County, Conn., group and the Long Island club is being planned.

—Norman C. Ferguson

♦ The 14th Annual Printing Education Week will be observed January 12–17, 1942. This observance is sponsored by The National Graphic Arts Education Association, Washington, D. C.

News Notes

♦ The Federal Civil Service Commission is again recruiting teachers for Indian community and boarding schools. The last examination for these positions did not produce enough qualified applicants in the agriculture and home economics options. The examination is reannounced for these two options, with two additional fields: farm mechanics, and one- and two-room day schools. Salaries range from $1,620 to $2,000 a year.

The Department of the Interior expects Indian Service teachers to be active participants in the life of the community in which they work and to find within the community much of the material for their educational program. The teachers associate constantly with Indians and it is necessary that they have a full appreciation of the Indian viewpoint and culture — their native arts and crafts, music, and religious ceremonials.

Applicants for these positions must have completed an appropriate 4-year college course. Two years of teaching experience in schools below college level is required.

Applications must be filed with the United States Civil Service Commission not later than December 11, 1941. The announcement giving detailed requirements for this examination may be consulted or obtained at any first- or second-class post office or at the Commission's Washington office.

♦ The USO needs games, and the industrial-arts classes throughout the country could do an excellent service to the boys in camp by making checkerboards, ring-toss games, backgammon, chessboards, shuffleboards, etc., and send them to the recreational centers of the camps.

The Chicago school system is already engaged in this fine work. They aim to supply approximatetly 10,000 games to the recreational centers of the army and navy stationed in the Chicago area.

♦ The tremendous part arc welding is playing in the present war effort, has prompted the Union of South Africa to issue a special postage stamp depicting a welder at work. This probably is the first stamp issued which shows a modern welder engaged at his trade.

● Lyon Steel Shop Equipment is designed by engineers who know present-day requirements and problems of both factory and school. Lyon Drawing Tables, Welding Benches, Woodworking Benches, etc., provide maximum working areas and storage facilities in minimum space. Scores of schools have solved the problem of handling larger classes by modernizing present classrooms with practical, efficient Lyon Steel Equipment.

LYON METAL PRODUCTS, INCORPORATED
General Offices: 5201 Madison Avenue, Aurora, Ill.
Branches and Distributors in All Principal Cities

MAIL COUPON FOR FREE COPY

LYON SCHOOL EQUIPMENT *Service*

LYON METAL PRODUCTS, INCORPORATED
5201 Madison Avenue, Aurora, Illinois
Send FREE copy of Lyon Shop Equipment Catalog.
Name_____
Address_____
City_____ State_____

♦ The University of Texas, through its University Package Loan Library Bureau, has furnished free specialized reading material to upwards of 35,000 students.

These packets consist of periodical clippings, pamphlets, books, plays, and study outlines.

These mail-order courses, of which there are 269 at present, are a part of the offerings made by the extension division of the University of Texas.

New Publications

Airplane Lofting

By William Nelson. Cloth, 147 pages, 6¼ by 9¼ in., illustrated. Price, $1.80. Published by McGraw-Hill Book Co., New York, N. Y.

This book is to help the beginner in the mold loft where templates must be made, and many different kinds of sheet-metal layouts prepared. The subject matter has been divided into six parts in which airplane construction, lines and fairing of lines, models and shell expansion, templates, jigs, fixtures and forms, and special methods of photographic reproduction are thoroughly explained.

Woodworking Projects and Upholstery

By William T. Baxter and Paul G. Lackey. Cloth, 251 pages, 5¾ by 8¾ in., illustrated. Price, $2.50. Published by D. Van Nostrand Co., New York, N. Y.

A book for the beginner craftsman who wants to learn about the care and use of hand and power tools, the processes to be followed in woodworking, the method of finishing wood projects, and how to do upholstering.

Concrete Design and Construction

By W. Herbert Gibson and Walter Loring Webb. Cloth, 500 pages, 6 by 8½ in., illustrated. Price, $4.75. Published by American Technical Society, Chicago, Ill.

(Continued on the following page)

Which boy has the better chance?

• Which of these two boys is more likely to land a worthwhile job in industry —

The one taught with makeshift equipment, knowing neither the requirements nor the technique of quality workmanship?

Or the boy who has been trained with the same high grade equipment he will find in industry?

If your school is designed to fit students for industry, your finishing department is one where you can select all your equipment with assurance. Whether your courses cover painting and coating metal, wood, ceramics, automobile shop work, or any other material, DeVilbiss is the standard that leading companies use and prefer.

THE DEVILBISS COMPANY • TOLEDO, OHIO
Canadian Plant: WINDSOR, ONTARIO

"THE ABC OF SPRAY PAINTING" . . . is a book of helpful information about the operation of spray-painting equipment. Write for a free copy.

DEVILBISS SPRAY SYSTEMS

(Continued from previous page)

This is a revision of an earlier book. In it the authors present in simple language, the general theory of reinforced concrete design. Many of the problems are illustrated by fully worked out examples.

The mixing, transporting, and placing of concrete, and the use of modern concrete-handling machinery is also explained.

Engineering Tools and Processes

By Herman C. Hesse. Cloth, 627 pages, 6¼ by 9¼ in., illustrated. Price, $4.50. Published by D. Van Nostrand Co., New York, N. Y.

A text for a one-semester course on industrial-production technique. It contains a great many line and half-tone illustrations in order that the student may have all the help necessary in visualizing the many processes that a description of industrial life in this age necessitates.

The subject matter covers materials, engineering elements, power transmission, measurements, foundry work, forging, sheet-metal work, machine-shop working, woodworking, and mass-production processes.

A Manual of Aircraft Drafting

By Carl Lars Svensen, M.E. Cloth, 272 pages, 7 by 9¾ in., illustrated. Price, $2.75. Published by D. Van Nostrand Co., New York, N. Y.

This book is the product of a man well versed in engineering practice. The illustrations were prepared by men thoroughly acquainted with the production of drawings to be used in the manufacture of airplanes.

The book is divided into 18 chapters which deal of the subject from the viewpoint of the aircraft draftsman, the use of drafting equipment, the various types of drawing, fastenings, aircraft details, engines, and charts.

The book also contains numerous useful reference tables and a bibliography of books on aircraft and related subjects.

Handwork in Wood

By William Noyes, revised by Albert F. Siepert. Cloth, 258 pages, 5¾ by 8 in., illustrated. Price, $3. Published by The Manual Arts Press, Peoria, Ill.

This is a revision of the late William Noyes' well-known book. The reviser has rewritten and enriched Chapters I, III, V, and VI. Many new illustrations have been added and the whole has been brought up-to-date.

Source Material Guides for Course of Study Planning in Drawing for Wisconsin Schools

By John Callahan, State Superintendent of Public Instruction, Madison, Wisconsin, 1941. Paper cover, 60 pages, no charge.

A bulletin prepared by the Curriculum Committee of the Wisconsin Industrial Arts Association in cooperation with the Wisconsin Education Association and the Wisconsin State Department of Public Instruction. "For those who take the conservative viewpoint, effort has been made to present exact definitions of drawing as drawing" (Chapter V). "For the progressives, a very thorough study has been made of life situations in which the typical young, middle-aged, or old American will do what he is to do, either as a consumer or as a producer, or both, and do it better because he understands certain things in drawing" (Chapter IV).

Thirty "organization patterns" are listed in which drawing is used. Life situations are classified in terms of the organization pattern which is involved. Many sample drawings illustrating organization patterns adapted to typical life situations are included. The bulletin is a helpful direction pointer for course of study planning in drawing.

Speedball Textbook

By Ross F. George. Paper, 88 pages, 6 by 9 in., illustrated. Published by C. Howard Hunt Pen Co., Camden, N. J.

This is the 14th edition of this helpful book on pen and brush lettering and poster design. The book contains numerous alphabets, directions for letter spacing, poster layout, borders and ornament, and decorative initials.

Pen Tips on Cartooning

By Charles Stoner. Paper, 48 pages, 6 by 9 in., illustrated. Published by C. Howard Hunt Pen Co., Camden, N. J.

A brief but thorough explanation of the fundamentals of cartooning. It is well and interestingly illustrated. The subjects covered embrace materials, pen control, tones and techniques, animation, hands, arms, feet, expression, animal cartoons, light and shadow, perspective composition, comics, caricatures, and the use of cartoons.

Linoleum Block Printing With Color

By Henry Frankenfield. Paper, 48 pages, 6 by 9 in., illustrated. Published by C. Howard Hunt Pen Co., Camden, N. J.

A second edition of a thorough explanation of how to cut linoleum blocks for color printing. The book is well illustrated and shows a number of simple reproductions produced in color, all of which are good examples of what may be attained with linoleum blocks.

Block Printing With Linoleum

By Henry Frankenfield. Paper, 48 pages, 6 by 9 in., illustrated. Published by C. Howard Hunt Pen Co., Camden, N. J.

This is the third edition of this book on the art of linoleum block cutting. It describes the materials, tools, use of tools, techniques of cutting, the distribution of line and mass, lettering, and the general use of block printing.

Amateur Radio — A Beginner's Guide

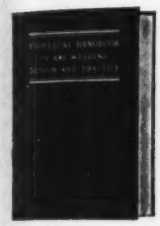
Cloth bound, gold stamped, 156 pages, and over 100 illustrations. Price, 75 cents. Distributed by Thordarson Electric Mfg. Co., 500 W. Huron St., Chicago, Ill.

This guidebook is designed for the amateur radio beginner. It contains all the necessary information, plans, diagrams, etc., for the actual construction of a complete rig to go on the air.

The reader is first introduced to amateur radio. Fundamental theory is then presented, and actual construction is begun on the first necessary piece

(Continued on page 24A)

The leading books on



ARC WELDING

Used by hundreds of schools and colleges

"Procedure Handbook of Arc Welding Design and Practice." Authentic reference guide on all phases of arc welding. 1152 pages. 1557 illustrations. Price $1.50 postpaid in U. S. A.; $2.00 elsewhere.

"Lessons in Arc Welding." Complete and expert instruction in all phases of arc welding practice. 60 individual lessons. 184 pages. 170 illustrations. Price 50c postpaid in U. S. A.; 75c elsewhere.

"Simple Blueprint Reading." Provides simplified approach to easy mastery of blueprint reading. 138 pages. 100 illustrations. Price 50c postpaid in U. S. A.; 75c elsewhere.

"Arc Welding in Design, Manufacture and Construction." Includes 109 outstanding welding studies from the $200,000 Award Program of The James F. Lincoln Arc Welding Foundation. 1408 pages. 695 illustrations. Price $1.50 postpaid in U. S. A.; $2.00 elsewhere.

"Welding Metallurgy." Easy to understand. Authoritative. 359 pages. About 140 illustrations. Price $1.50 postpaid in U. S. A.; $2.00 elsewhere.

THE LINCOLN ELECTRIC CO.
Educational Dept. Cleveland, Ohio

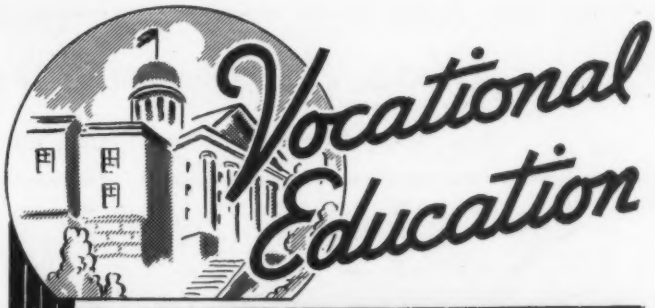
ARMSTRONG
TOOL HOLDERS and TOOLS

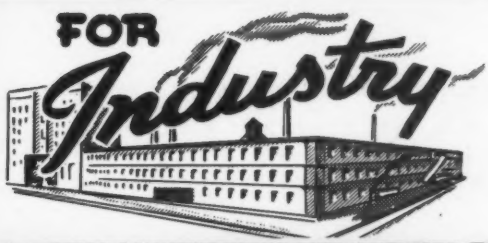
Each with the Tools actually Used in Industry

OLDERS—used in over 96% of the Machine Shops and ol Rooms. Develop "tool sense" and a love for fine ols with ARMSTRONG Drop Forged WRENCHES — rbon and Chrome-Vanadium Steel Open End Wrenches; x Socket and Detachable Socket Wrenches with im- ved designs, better balance, finer machining and finish. up jobs with modern, safe, ARMSTRONG Drop Forged tting-Up Tools. Use ARMSTRONG Drop Forged Clamps t never slip, spring or spread, and ARMSTRONG Drop rged Lathe Dogs that are standard everywhere.

● *Write for Cutter Grinding Charts and new C-39 Catalog. Sent to Instructors upon request.*

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
322 N. FRANCISCO AVE., CHICAGO, U.S.A.
Eastern Warehouse & Sales Office: 199 Lafayette St., N. Y.





Behind America's fighting men stands the most powerful industrial army in the world — an army trained in modern vocational schools equipped with modern tools.

RACINE saws are receiving first call for vocational training as **RACINE** modern hydraulic metal cutting machines are used everywhere in industry and in the three branches of the armed service. Write for information on **RACINE** utility saws especially designed for school and general shop use — or on the full line of saws from 6"x6" to 14"x20".

Racine Tool & Machine Co.
1760-1 State St. Racine, Wis., U. S.A.

Shop Equipment News

New Products — Publications

NEW 20-IN. POWER-FEED DRILL PRESS

The Walker-Turner Co., Inc., Plainfield, N. J., is manufacturing a 20-in. drill press that will be available for power-feed, hand-feed, or foot-feed applications. The machine is of exceptionally rugged construction and makes an ideal production machine.

20-in. Power-feed drill press

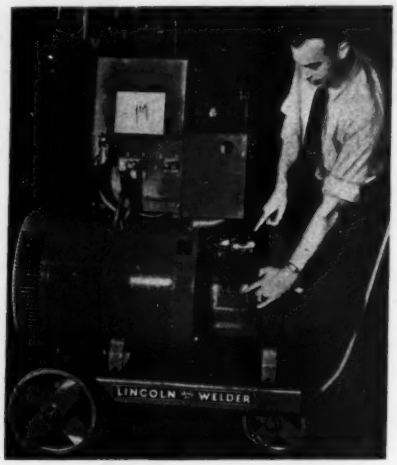
One of the features of outstanding note is the power-feed unit; a built-in clutch which is part of the worm drive assures smooth positive action at all points of spindle travel. In keeping with the accepted practice the unit is powered from the drill-press spindle, four rates of feed speed are provided for each of the five spindle speeds and an easily read chart indicates the rate of feed in thousandths of an inch per revolution of spindle. This range will handle efficiently all drilling and reaming operations from 1 in. in cast iron down to 1/16 in. The machine is equipped with a No. 2 Morse taper spindle nose and is available in single spindle or four-spindle models.

NEW LINCOLN PROTECTIVE CONTROL DEVICE

Complete protection against heat or excessive current, or both, is provided by a new protective control device for arc-welding machines, just announced by The Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

This permits operation of a welding machine equipped with this new device to be operated at maximum capacity for long periods without harm.

The protective control device consists of two current transformers, the primaries of which are connected in series with the motor leads, and the secondaries supplying power to operate two snap-action thermostats which are mounted directly on the motor lamination.



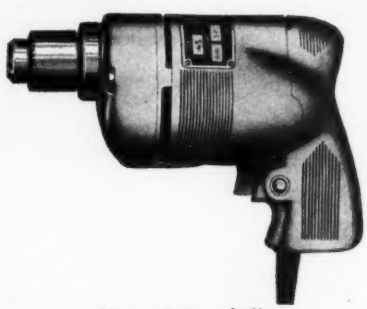
Courtesy, Lincoln Electric Co., Cleveland, Ohio

The thermostats automatically reset when the motor returns to a safe operating temperature or when the current is reduced, and no manual operation is required to start the machine, except pushing the starter button.

A special circuit allows the starter button to be held "in" after the welder thermostats have been tripped. This allows the machine to rotate with no load and the welder ventilation speeds up the cooling of the welder after the trouble has been rectified.

SKILSAW ANNOUNCES NEW ¼-IN. DRILL

A new ¼-in. drill, called Skildrill, and proclaimed "The Mightiest Mite of the Drill Field," has just been announced by Skilsaw, Inc., 5033–43 Elston Ave., Chicago.



New ¼-in. drill

The new Skildrill weighs only 2¾ lb., is 6⅝ in. long over-all and 2 9/16 in. wide. It fits most comfortably in the palm of a man's hand and is excellent for drilling in tight spots. Its ease of handling makes it a perfect drill for all production work in aircraft, tank, automobile, refrigerator, and other industrial fabrication, and for maintenance work.

It has a die-cast body, antifriction ball and needle-roller bearings, helical-cut gears, and a universal motor with a two-pole momentary-contact switch with lock for continuous operation.

It has a no-load speed of 1800 r.p.m., and a full-load speed of 1050 r.p.m. Drilling capacity in steel is ¼ in. and in hardwood ½ in.

NEW INK BOTTLE

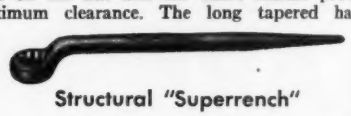
The illustration shown depicts the repackaging of Higgins Engrossing Ink from a 1½-oz. round bottle to a 2-oz. cube bottle with broad, flat cap. Suggested uses and simplified directions are printed in as few words as possible on both

New ink bottle

cap and label. The remerchandising of Higgins Engrossing Ink is another step in the policy of modernizing their complete line of drawing inks, writing inks, adhesives, and sealing wax, which Higgins Ink Co., Inc., 271 Ninth St., Brooklyn, N. Y., has. The cube bottles by Hazel Atlas with caps from National Seal may be easily stacked.

WILLIAMS' "SUPERRENCHES" IN STRUCTURAL BOX PATTERN

J. H. Williams & Co., 225 Lafayette St., New York City, have recently added a Structural Box Pattern wrench to their line of chrome-molybdenum "Superrenches." The new wrench is designed to bring greater safety to structural work. The 12-point box head insures a firm hold on the nut and the offset handle provides maximum clearance. The long tapered handle



Structural "Superrench"

provides ample strength and leverage and is of the type preferred by steel workers for lining up bolt holes. These wrenches are available in 6 sizes with openings 1 7/16 to 2⅜ in., accommodating U. S. Std. Nuts ⅞ to 1½ in. They are forged from chrome-molybdenum steel, heat-treated, and finished in baked gray enamel over all.

FOUR HELPFUL BOOKS

In order to be of greater assistance to the teachers of industrial arts and vocational education throughout the country, The R. K. LeBlond Machine Tool Co., manufacturers of Super Regal Lathes, are offering free to instructors, a complete set of four helpful books as advertised on the back cover of this issue.

While one copy of each book is given to instructors, where extra copies are requested for students, a charge of 25 cents per copy will be made to cover the cost of handling and mailing.

The four books, widely acknowledged by leading educators as first-rate aids to instructors, are as follows:

MARCH OF THE MASTERS. Fifty-two-page book presenting an inspirational story for the student machinist, plus complete specifications on all lathes in the Super Regal line.

TOOLROOM GRINDING. A complete 52-page manual of toolroom grinding. This up-to-date manual is clear and concise, amply illustrated with large photographs, charts, and diagrams. A liberal education in toolroom grinding, of great value in shops equipped with toolroom grinders, is presented.

RUNNING A REGAL. A handy handbook welcomed by student machinists everywhere. One hundred twelve pages with over 120 illustra-

(Continued on page 23A)

Part I

"Little Talks From Western"

"Die Cutting The Envelope"

This Process, Though Old, is Important for Proper Envelope Manufacture. Approximately a Ream of Paper is Aligned, Clamped and Weighted on a Movable Cutting Board.

Western Serves Your Community

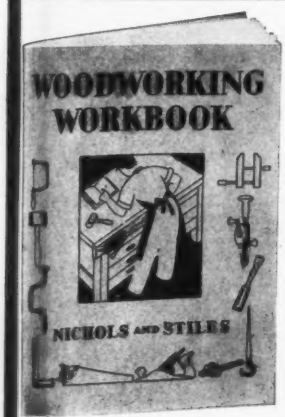
Instructors:
Write Today!
For Your Free Manual and Samples, Which Show More Clearly Exactly Who We Are —And What We Do.

The Correct Die Outlineing

The Envelope for the Size and Style Desired is Placed on the Paper. The Board Then Slides Under a Reciprocating Head Where 8000 lbs. of Pressure Drives The Die Thru The Paper.

Western States Has Over 6000 Solid Dies and Adjustable Blades to Make Every Conceivable Type of Envelope. Western States Aims to Please The Trade Completely, Consequently They Employ More Costly Machinery and Dies to do a More Efficient Job.

Western States Envelope Co.
1616 W. Pierce Street Milwaukee, Wis.



Make your teaching more effective with

WOODWORKING WORKBOOK

By Nichols and Stiles

A workbook for beginners. Easy to use. Presents basic information in simple form. Clearly illustrated. Selected questions with appropriate answer space. Covers: important information for beginners, wood, lumber, tools, processes, fasteners, finishes, references, activity suggestions, etc. Order now on approval. Ready January 5.

64 large pages
Size 7½" x 10½"
70 Illustrations
ONLY 68 CENTS
Quantity Discounts

The Manual Arts Press
Peoria, Illinois
....., 194.....

Please send billed on APPROVAL

WOODWORKING WORKBOOK, *Nichols and Stiles*

Name .....

Address .....

City and State .....

School and Position .....

MAXIMUM SAFETY
OPERATION SILENT AND EASY

OLIVER

No. 399

SINGLE SURFACE PLANER

The No. 399 surface planer is one of the champions of the Junior Line of "Oliver" Woodworking Machines. It will give many years of fine service, handling boards up to 18" in width and 6" in thickness. This surface planer is built of the finest quality materials, and embodies every possible safety device. Used widely in Industry and in school shops.

The list of Junior Woodworking Machines includes: 18" Band Saw, Boring Machine, 7" Saw Bench, Oilstone Tool Grinder, Speed Lathe, Mortiser, 18" Surfacer, 6" Jointer, Wood Trimmer, Shaper, Vises, Belt Sander, Disk Sander.

Oliver Machinery Company
Grand Rapids, Michigan, U.S.A.
HIGH GRADE MACHINERY

WOODWORKING TOOLS HARDWARE and SUPPLIES

For Every School Shop

We are in a position to render very definite service to directors and shop instructors for the equipping of their school shops with well known quality tools, supplies and equipment. Your students, to prepare them for defense work, should become familiar with the same equipment they will find in industry.

Our complete catalog "K" will be mailed to supervisors, directors and shop instructors upon request without cost or obligation. Write for copy today.

Lussky White & Coolidge, Inc.
65-71 W. Lake St. Dept. C-1 Chicago, Illinois

Est. 1883

WEBER

DRAWING MATERIALS ARTISTS' MATERIALS

STUDIO, SCHOOL, and DRAFTING ROOM FURNITURE

Write for Catalogue Vol. 700

F. WEBER CO.
MANUFACTURERS

Office and Factory Address:
1220 BUTTONWOOD ST., PHILADELPHIA, PA.
ST. LOUIS, MO. 706 Pine St.
BALTIMORE, MD. 227 Park Ave.

Patronize Your Nearest WEBER Dealer

LEATHERCRAFT SUPPLIES

FANCY LEATHERS (whole or half skins or cut to measure)
TOOLS DESIGNS
LACINGS (both calf and goat skin)
Snap Fasteners to match leathers
10 strand belts to braid
Dye, Wax Polish
Sphinx Paste
Slide Fasteners
Belt Plates
Bag Buckles
Book on leather work $1.00 postpaid

For many years we have specialized in catering to the needs of the leathercrafter. Our stocks are complete . . . . our prices the lowest.

SEND 5c IN STAMPS for Samples in Art Leathers

Ideas and suggestions on this fascinating work yours for the asking. *May we serve you?*

W. A. HALL & SON
99 Bedford Street Boston, Mass.

Thousands of Industrial Arts Instructors, in all parts of the country, have already received our new Catalog of

"HARD-TO-GET" MATERIALS

This is our twenty-sixth annual catalog. Many new and unusual materials have been added. No instructor can afford to be without this source of supply on hard-to-get items. Send for the catalog today. Study it over carefully. The ideas you receive will be of real value. A few of the items we handle:

Chest hardware, locks, hinges, supports, tray lifts, copper trim, also mouldings, overlays, etc. Finishing materials, glue, stain, varnish, abrasive papers, sanding blocks, stick shellac, etc. Upholstering supplies, coverings and tools. Electrical findings for lamp manufacture also clusters and indirect fixtures. Chair cane, spline, reeds, craft fibre cord, etc. Trays and glass liners for smoking stands. Large line electric and spring clock movements, with and without dials. Complete line Venetian Blind hardware, cord, tapes, etc. Table slides and supports. Tea wagon wheels and casters. Wood dowels, also dowel screws, dowel centers, wood screw hole buttons. Large line card table leg supports. Bed hardware of every description. Desk pens complete with funnels and fastening without base. Water transfers, inlays, small mouldings, etc. Glides and casters, office chair spiders, wood legs and K. D. chair frames. Small box hardware of every description. Large selection pulls, knobs, handles, hinges, locks, catches, etc. Perforated steel panels, chair braces, revolving chair fixtures, rocker springs, candlestick sockets, billboard clamps, banquet table hardware, metal drawer glides, brass jack chain, drawer follower blocks, etc. Many styles corner braces, bolts, etc. Step ladder braces, pilaster strips, sliding track and sheaves. Typewriter desk hardware, binswings, mirrors, nut bowl hardware, salt and pepper inserts, music box movements, etc. Bar pins for novelties, dress clips, etc. Catalin Plastics, crib hardware, swivel top table fixtures, sectional bookcase hardware, clamp nails, electric pens for burning, etc.

Anoka **THURSTON SUPPLY COMPANY** Minnesota

Craft Supplies of Every Type

Complete Materials, Tools, Patterns, Designs and Instructions for Leathercraft, Metalcraft and Jewelry, Plastics and twenty other crafts from 17 FULLY STOCKED DISTRIBUTION POINTS.

Now, wherever you are, you can secure everything you need for your craftwork program within forty-eight hours from one of seventeen Fellowcrafters' fully stocked distributors. Write today for the latest issue of "The Fellowcrafter", the new craft newspaper which tells you about new materials, new techniques and new instruction books for crafts, and about the seventeen convenient stocks from which you may order these and receive prompt service and lower shipping charges.

FELLOWCRAFTERS, Inc.
64 STANHOPE STREET, BOSTON, MASS.

BALDOR BALL BEARING GRINDERS

The COMPLETE LINE of BALDOR Grinders (bench and pedestal types) described in BULLETIN 307. Ask for it.

A powerful, heavy-duty 10" Grinder. Heavier and more H. P. than usual for its wheel size. 1½ h. p., 3-phase motor; 220 volts, 60 cy., 1725 r. p. m. 10"x1" wheels. NET WEIGHT, bench type, 188 lbs. (Also available in pedestal type) 1-YEAR GUARANTEE.

No. 101 — Bench Type — **$90.00**

BALDOR ELECTRIC COMPANY
4325 Duncan Ave., St. Louis, Mo.

Have You Seen X-acto . . .

the INTERCHANGEABLE KNIFE

X-acto is different than ordinary knives . . . the blade is interchangeable. Handles furnished with 8 varied shapes for various uses. Extra blades attractively priced for economy. Made of surgeons' steel.

Write for catalog and sample offer.

X-acto
Keener Knives, Replaceable Blades

X-acto Crescent Products Co., Inc.
440 - 4th Avenue, New York, N. Y.

Rub-Er-Spra

World's Finest Liquid Rubber for Mold-making

The use of this high quality, fool-proof, flexible mold making material enables the instructor to offer his students low-cost interesting projects in plaster casting. You will find these projects to be a real leader in creating enthusiasm either in high school, grammar school or summer camp crafts.

GALLON **$6.95** WITH HAND SPRAY GUN

FREE!
WRITE FOR OUR Big 48-Page BOOK
Crammed full of valuable information to the craft instructor.

NEW LIQUID PLASTIC

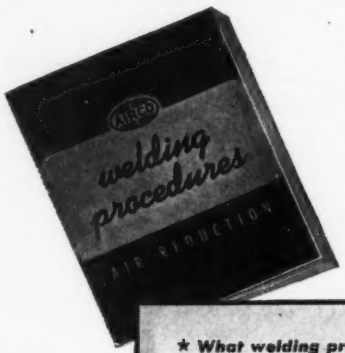
A really good easy working plastic that can be cast in rubber molds. Class rings, school seals, novelties of all types make excellent projects. Our book gives details and working instructions.

OTHER MATERIALS

Pearl Essence Lacquer—Lacquer Tinting Colors—Best Quality Molding Plaster—Over 200 Beautiful Models for reproduction—Modeling Clay—Artist's Paints and Brushes—Spraying Equipment—Air brushes—Rubber Molds—Staples and rings for hanging plaques. Our book gives you complete information on these and other items. Be sure to write for your copy.

STEWART'S STUDIOS, Dept. VE-8, 1008 George St., Lake Geneva, Wis.

NEW BOOK ON WELDING
tells you clearly



Helping you select the proper welding process for a particular metal under given circumstances — that's the job that is done with unusual clarity in this new 55-page Airco bulletin. Single copies are available upon request. Please write on your business letterhead to Air Reduction, 60 East 42nd St., New York, N. Y.

★ *What welding process to use.*
★ *Individual weld characteristics of all commonly used metals.*
★ *Which welding procedure to follow.*
★ *How to estimate cost of welding.*

AIR REDUCTION
General Offices:
60 East 42nd St., New York City

DIXON TOOLS AND SUPPLIES
for Metal Crafts

Our Arts and Crafts Catalog is Free to Industrial Arts Teachers

WILLIAM DIXON INCORPORATED
32 EAST KINNEY STREET, NEWARK, N. J.
Manufacturers of Tools and Supplies of Quality

(Continued from page 20A)

tions — a comprehensive instruction book, covering all phases of lathe operation and maintenance.

AMERICA SINGS. Strikingly illustrated with colorful murals, depicting in symbolic realism the American scene yesterday, today and tomorrow. The accompanying story is that of the complete line of LeBlond machine tools.

Instructors should address their requests for free copies of any or all of the above literature to: The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

SUPPLEMENT TO LECTURE COURSE ON COATED ABRASIVES

The Behr-Manning Corp., Troy, N. Y., have just issued a supplement to the "Lecture Course on Coated Abrasives."

Accordingly, a supplement has been prepared on "Belt Sanding in the Woodworking Industry." It is well illustrated and the subject matter is brief. No attempt has been made to cover all belt-sanding equipment, but rather to show representative types that students will find when they get into modern industry.

Other supplements are planned for the future. It is advisable, therefore, to keep the lecture course constantly on hand, and add the supplements as they are issued.

FIFTY NEW U. S. OFFICE OF EDUCATION DEFENSE TRAINING FILMS GO INTO IMMEDIATE USE

Fifty machinist and industrial-training films are being prepared under the direction of the United States Office of Education. Several of them are already being used by machinists, operators, and apprentices in one of Chicago's defense plants.

The Bell & Howell Co., Chicago, in addition to its own intensive use of the films, is devoting its film library channels to the loan and sale of copies to industries, schools, and other organizations. Printing and general distribution is handled by Castle Films, under government contract.

By the middle of November at least eighteen of the subjects, each playing from ten to thirty minutes, will be available.

The films may be purchased at a price that represents bare printing and shipping cost, with the entire expense of actually producing the negatives absorbed by the government.

The pictures can be run on any 16mm. sound projector, but silent machines cannot be used. Firms, schools, or educational institutions having no machines can make arrangements for projection service, and can borrow copies of the films desired, at a moderate handling charge.

NEW HIGGINS CATALOG

The Higgins Ink Co., Inc., 271 Ninth St., Brooklyn, N. Y., has issued a new illustrated catalog. Modern layouts supplemented by fine half-tone engravings are used on enameled stock throughout the catalog to show the dealer and consumer the actual merchandise in all its prize-winning beauty. These are the same packages supplemented by other improved packages which won the Modern Packaging Award in 1938.

One of the outstanding features of Higgins' new catalog is a color wheel on the inside front cover which is made from actual swatches of Higgins drawing inks applied on white drawing paper. A code explained in a single paragraph below this color chart enables anyone to order by number the desired colors and sizes. All listings in the catalog show product numbers.

Other features are demonstration inserts with strong selling points which accompany most listings and an eye-saving use of rules which makes it easy for the dealer or consumer to locate the article wanted and the price.

AVIATION-TRAINING FILM RELEASED

Brandon Films, 1600 Broadway, New York City, are ready to distribute a new Garrison motion-picture training aid, *Aviation Engine: Disassembly and Inspection*. The film was produced in cooperation with the Missouri Aviation Institute. It is available in two versions, 16mm. silent (2 reels) and 16mm. sound (2 reels).

The film is designed for use in training groups where an actual airplane engine is not available. The picture introduces the various major units that make up the radiol type of engine; identifies the units and indicates the functions. It also identifies the subassembly units and illustrates methods of locating cracks in parts of the engine.

VISUAL EDUCATION IN DEFENSE TRAINING

Properly constructed visual aids will be of great value in advancing the nation-wide program of training for defense workers, according to Dr. John W. Studebaker, United States Commissioner of Education.

The United States Office of Education has produced a series of motion-picture films dealing with mechanical skills and knowledge, and expressly designed to be used by vocational teachers and shop instructors. These films, it is believed, will assist potential and employed defense workers more rapidly to learn and more thoroughly to comprehend the instruction given them in the vocational schools of the nation.

The Office of Education has entered into a contract with Castle Films, Inc., which will market the 16mm. sound-on-film reels at less than nine dollars a reel. Eighteen of the 50 reels are now completed and the balance will be finished shortly. The library of 50 reels has been collected to cover all phases of machine-shop practice in precision metalworking. The subjects covered are precision measuring, benchwork, engine lathe, milling, drills of various types, and shipbuilding.

NEWLY APPOINTED

The Carborundum Co., Niagara Falls, N. Y., announce the appointment of J. E. Donald Hastie to their educational service department.

THE MARKET PLACE

STERLING STEEL FLASKS

Made of Specially Rolled Copper Bearing Rust-Resisting Steel Channel sections having a solid center Rib and Solid Sand Flanges at Top and Bottom.

Write for Catalog of Flasks and Other Foundry Equipment

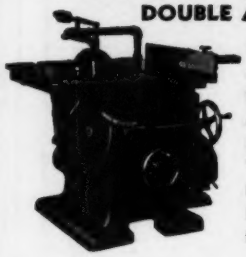
STERLING WHEELBARROW CO., Milwaukee, Wis.

LUMBER

We solicit your inquiries and orders for Ash — Hickory — Basswood — Maple — Poplar — Gumwood — Red Cedar — Western Pine — Yellow Pine — Birch — Walnut — Chestnut — Elm — Oak — Cherry — Mahogany — Cypress. *Write to*

THE TEGGE LUMBER COMPANY
1500 West Bruce Street Milwaukee, Wis.

TANNEWITZ
DOUBLE ARBOR SAW



Two saws, a 14" Rip and 14" Cross-cut instantly interchangeable. 5 H.P. motor in base. Multiple V-Belt drive. Sliding table. Completely universal. Send for circular.

The Tannewitz Works Grand Rapids

High Grade
Printing Inks

For SCHOOL PRINT SHOPS

COVERWELL INKS FOR QUALITY PRINTING

MARTIN DRISCOLL & CO.
610 Federal St. Chicago, Ill. Portland, Oregon 407 E. Michigan St. Milwaukee, Wis.

GEM STONE CUTTING

Our 44 page TENTH ANNIVERSARY CATALOG illustrates and describes complete gem cutting equipment and supplies. Rough and polished gem stones for Art Craft Classes. Send for your free copy today.

WARNER & GRIEGER
405 Ninita Parkway Pasadena, Calif.

RHODES COMBINATION
7-Inch Shaper and 3½-Inch Slotter

RMC

1. A precision Tool. 2. Ideally suited for school use. 3. Small floor space and power requirements. 4. Exceptional instructional value. *Write for details*

THE RHODES MFG. CO.
Waltham, Mass.

HANDICRAFTS
Free Catalog

150 page, spiral wire-bound catalog 40 page supplement, listing all tools, supplies and equipment for Handicrafts and Creative Arts programs. Bristling with new ideas and processes. Write on school stationery.

UNIVERSAL
HANDICRAFTS SERVICE, Inc.
1267 Sixth Ave (50th) New York, N. Y. CO. 5-0163

KNOCKDOWN CEDAR CHEST

Foreign and Domestic Lumber and Veneers.
Write Today for Illustrated Catalog.
GILES & KENDALL CO., Decatur, Ala.

LUMBER FOR SCHOOLS

T. A. FOLEY LUMBER CO.
PARIS, ILL.

LEATHERCRAFT

LEATHERS, LACING, TOOLS, ZIPPERS, SNAPS, ALL WOOL FELT, BEADS, WOOD PLAQUES, AND NEW FLEXIBLE WOODEN SOLE SANDLE KITS.

Schools send stamp for catalogue.

LAPCHESKE LEATHER COMPANY
1717 West 23rd Street Des Moines, Iowa

Craftsmanual
WRITE *for it* **TODAY** **FREE**

Just send 25c (stamps or coin) for introductory jumbo package of Monite Glue (Aircraft grade) dependable for all inside and outside projects, and receive *free* a copy of our 16-page Craftsmanual complete with working plans.

Monite Waterproof Glue Co.
205 Monite Building
Minneapolis, Minnesota

STA-WARM TRIPLEX
3 Heat Glue Pot

A low cost, high efficiency quality Electric Glue Pot with 3 heating control —
1. Low—for intermittant use.
2. Med.—for continuous use.
3. High—for quick heating.

Write for details on its 17 advantages.

1 pt. - $6.75
1 qt. - 7.25
2 qt. - 9.25

Details also available on other Sta-Warms. 1 pt. to 8 qt., with automatic control.

STA-WARM ELECTRIC CO., Ravenna, Ohio
Rep. by Oliver Machy. Co. Gr. Rapids, Mich.

SHOP SUPPLIES
TOOLS AND MACHINERY
Headquarters for School Woodworking Equipment

Large and complete stock of woodworking machinery, tools and supplies. (Also good bargains in rebuilt machines.) *Knife grinding and saw filing a specialty*—quick service. Complete shop for expert machinery and tool repairs—satisfaction guaranteed. Write for catalog.

WOODWORKERS' TOOL WORKS
224 S. Jefferson St. Chicago, Ill.

HOYT'S GENUINE PEWTER

is the highest grade. Shapes without cracking or peeling. Sheets up to 24"x36"; discs, 2" to 24" diameter. Write for further information and instruction sheets.

NATIONAL LEAD CO., Dept. P
New York Chicago St. Louis

LEATHERCRAFT

Everything in **LEATHER**

A complete line of leathers tools, accessories, patterns, instructions, etc. Guaranteed quality—lowest prices New white moccasin Kits—ideal for boys and girls.

Write today for free 84-page Catalog No. 1A!

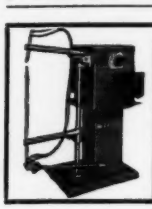
OSBORN BROS. 223 Jackson Blvd., Chicago, U.S.A

. SILK SCREEN PROCESS .

Today's modern method for economically reproducing all manner of posters, signs, lettering, and displays in colors. For full particulars, write . . .

SILK SCREEN SUPPLIES, Inc.
33 Lafayette Ave. Brooklyn, N. Y.

POTTERY
KILNS—CLAYS—GLAZES
WRITE DEPARTMENT B FOR COMPLETE CATALOG
AMERICAN ART CLAY CO., INDIANAPOLIS



We manufacture a complete line of equipment:
COLLEGE GLASS working units for students and laboratory. SPOT WELDERS and A. C. ARC WELDERS. TRANSFORMERS, special and standard types. INCANDESCENT LAMP manufacturing equipment. RADIO TUBES, ex-ray, cathode ray, photo cells. ELECTRONIC EQUIPMENT, vacuum pumps, etc. NEON UNITS, blow torches and burners of all kinds. GENERAL GLASS working machines and ribbon burners.

EISLER ENGINEERING CO.
CHAS. EISLER, Pres.
767 So. 13th St. (Near Avon Ave.) Newark, New Jersey

PEWTER
FOR SPINNING

Circles—2" to 20" dia.—14-15-16-18 ga.
Sheets—18"x24"—12-14-15-16-18 ga.
Square Wires—⅛"-5/32"-¼"-5/16"
approx. sizes
Tubing—3/16"-¼"-5/16"-½"—all inside dia.
Rods—⅛"-5/32"-¼"-5/16"—approx. dia.
Hinges—1" and ⅝"
Slugs—1¼"-1"-⅞"-¾"—dia.
(in any thickness)
Pewter Solder—70/30—12 ga. round
65/35—Half Round
60/40—flat jewelers strip

Casting Metal for School Foundries
Send 6c in stamps for new teaching aids and information.

WHITE METAL
ROLLING & STAMPING CORP.
70 Moultrie St. Brooklyn, N. Y.
Telephones, EVergreen 9-4134-5-6

SEEKING A POSITION?

The unusual demand for teachers of Industrial Arts and Vocational subjects offers exceptional opportunities to beginning teachers and to experienced men who are looking for advancement. Many vacancies in East and South. Write us about yourself.

THE BALTIMORE TEACHERS AGENCY
William K. Yocum, Manager
516 N. Charles Street Baltimore, Md.

T-31 ABRASIVE DISC CEMENT

T-31 will solve your sanding problems. It is a pressure sensitive cement—the harder the work, the tighter it sticks.

T-31 may be used on sanding discs, drums or blocks. It is ready for use—it requires no heating or mixing It dries quickly to a permanently tacky film

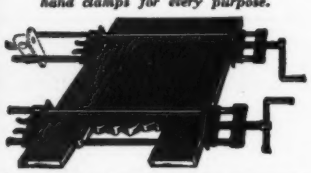
T-31 saves abrasive paper. It permits rapid changing from one grit to another and back again without destroying the paper.

T-31 can be obtained from your dealer in several convenient sizes or direct from us in a handy, brush-in-cap, half-pint can at $ .60 postpaid. Box V67
FANWOOD SPECIALTIES CO. Plainfield, N. J.

HARTFORD CLAMPS

Hartford Single and Double Bar, Self-Locking and Unlocking Clamps have been standard in most schools for over fifteen years.

Write for free catalog covering hand clamps for every purpose.



Note how the double bars keep the work from buckling.

HARTFORD CLAMP CO.
Bumside Connecticut

THE METAL CRAFTS

are becoming more and more popular in school work.

We were pioneers in this field and are prepared to give prompt and efficient service.

When buying supplies consult us for prices on equipment.

Ask for our catalog IA free to Industrial Arts Teachers.

Metal Crafts Supply Company
10 Thomas St., Providence, R. I.

NEW PUBLICATIONS

(Continued from page 18A)

of apparatus, the code oscillator. Then comes the building of a receiver, crystal oscillator transmitter, two-stage transmitter and other amateur equipment. The book is clearly written and the reader without any previous radio experience should have no difficulty in passing his examination and building his own equipment.

The book is an excellent reference work for both the beginner and experienced operator, for it contains information on the various parts and purposes of amateur equipment, symbols, list of Q signals, helpful hints, etc.

Halftone Processes

By A. J. Lockrey. This is a practical working treatise for the amateur or professional, describing methods and materials for all types of photomechanical reproduction. Published by J. J. Tepper Corp., 30 Rockefeller Plaza, New York, N. Y. Price, $1.

Making Models of Famous Ships

By Ray J. Marran. Cloth, 152 pages, 5½ by 8¼ in., illustrated. Price, $2. Published by D. Appleton-Century Co., New York, N. Y.

An interesting book, which, while not claiming to present exact scale models of all of the ships presented, nevertheless gives enough carefully computed dimensions so that the models closely resemble the ships they are to represent.

The ships described vary from the first primitive boats up to the fast *Yankee Clipper*. There are Egyptian sailboats; galleys; Viking ships; junks; the ships of Columbus; Magellan's; Drake; Hudson; and the Mayflower.

Needlework and Crafts

By Irene Davison and others. Cloth, 340 pages, 4¾ by 7¾ in., illustrated. Price, $2. Distributed by Chemical Publishing Co., New York, N. Y.

A comprehensive book covering plain sewing, using the sewing machine, hand embroidery, dressmaking, mending, crocheting, raffia work, stenciling, weaving, leatherwork, basketry, and knitting.

MISCELLANEOUS BOOKS AND PAMPHLETS

Among the books and pamphlets received which may be of interest to shop teachers are the following:

Superintendent's Digest of Professional Literature

By William H. Johnson, Superintendent of Schools, Chicago, Ill.

Steps in a Community Occupational Survey

By Marguerite W. Zapoleon, Specialist, Occupational Information and Guidance Service, Vocational Division, U. S. Office of Education, Washington, D. C.

Bibliography of Economic and Social Study Material

This is a list of literature and visual aids which interested persons may obtain from the National Association of Manufacturers, 14 West 49th St., New York, N. Y.

Milwaukee Youth Report Their Status

A study of the educational and employment conditions of 47,349 young people in Milwaukee between the ages of 19 and 25, conducted by The Milwaukee Vocational School, Milwaukee, Wis.

A Guidance Bookshelf on Occupations

A selected bibliography by Walter J. Greenleaf, Specialist, Occupational Information and Guidance Service, Federal Security Agency, U. S. Office of Education, Washington, D. C.

A Handbook of Pottery

By D. B. Lasseter. This bulletin is free to school administrators, teachers, libraries, vocational counselors, and government officials; it can be obtained from the National Youth Administration for Georgia, 10 Forsyth Street Building, Atlanta, Ga.

Christmas Greetings With Light

A 12-page booklet on novel indoor and outdoor Christmas lighting arrangements. This booklet was prepared by Westinghouse Editorial Service, East Pittsburgh, Pa.

FIRST and FINEST HANDEE

TOOL OF 1001 USES

Does precision work on metals, alloys, plastics, wood, horn, bone, glass, etc. Original tool of this type and the favorite today.

A WHOLE TOOLSHOP IN ONE HAND

Uses 300 accessories to grind, drill, polish, rout, cut, carve, sand, saw, sharpen, engrave. Plugs in any socket. Wt. 12 oz. 25,000 r.p.m. *$18.50* postpaid with 7 Accessories.

EVERY VOCATIONAL SCHOOL NEEDS THIS ULTRA DE LUXE SET

Strong, metal carrying case contains a DeLuxe model Handee and 45 of the most popular and most practical accessories. It's a good idea to begin with this set and then add accessories as needed.

Postpaid, *$25.00.*

ORDER on 10-DAYS MONEY-BACK TRIAL

FREE—64-page Catalog describes all Handee Products and their wide application in crafts and industry all over the world.

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe Street Dept. IA Chicago, Illinois

■■■ be sure to specify "how-to-do-it" A.T.S. textbooks and lessons texts when placing your book orders. Texts sent on approval. Complete catalogue sent free upon request.

American Technical Society
Publishers
Drexel Ave. at 58th St. Chicago, Ill. (Dept. H.S. 111)

It Has Everything!

B-G LUMBER

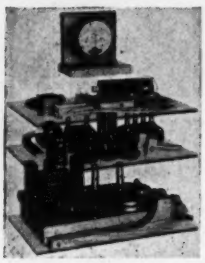
Super workability!—Super sandability!—Super glueability!—and super finishability! Every single lumber quality your students need for better, faster class work is found in this grand B-G Lumber. The reason:— it's Soft-Textured and Kiln-Dried. Favored in schools from coast to coast—by all means try it. A sample order will convince you!

You'll like B-G service on your supplies, too!

BRODHEAD-GARRETT CO.
"Supplying Schools in All 48 States"
CLEVELAND, OHIO

THE MARKET PLACE

A COMPLETE COURSE IN ESSENTIALS OF ELECTRICITY



"Learning Electricity Experimentally," by C. S. Siskind of Purdue University's Electrical Engineering School, was written around our Model 100-G equipment.

A copy of this text is furnished with each 100-G set sold, enabling an instructor to set up a modern course in electricity immediately upon receiving his set.

Our equipment is being used extensively and recommended by Army, Navy, NYA and CCC Defense Training Schools for quick and efficient instruction in electricity.

Write for illustrated booklet today.

UNIVERSAL SCIENTIFIC COMPANY, INC.
VINCENNES, INDIANA

"Westko Modeling Clay"

This clay is used in Schools and Art Institutions throughout the United States.

Write for prices and information

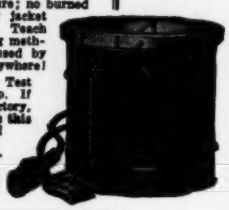
Western Stoneware Co.
Monmouth, Illinois

"Hold-Heet" GLUE POTS
are Standard in School Shops!

1 qt. $14
2 qt. $17
4 qt. $24
8 qt. $36
115 or 230 Volts

And here are the reasons: They're safe, fool-proof, built "like a boiler" to take plenty of shop abuse. Automatic Thermostat controls glue temperature; no burned or spoiled glue; no water jacket troubles; no fire hazards. Teach students modern, safe gluing methods with "Hold-Heet" — used by industry and schools everywhere!

30 DAY FREE TRIAL. Test "Hold-Heet" in your shop. If it is not entirely satisfactory, send it back. Play safe with this superior Electric Glue Pot!



RUSSELL ELECTRIC CO.
364N West Huron St.
CHICAGO, ILL.

Specify

PAXTON

For highest quality in grade, texture and kiln drying.

Remember—the project can be no better than the materials from which it is made.

FRANK PAXTON LUMBER CO.
Des Moines — Denver
Fort Worth — Kansas City

Industrial Furnaces
FORGES - MELTERS - OVENS

Complete Tables
BLOW PIPES
Suitable sizes for school shops
Write for complete information

American Gas Furnace Co.
ELIZABETH, N. J.

ELECTRO - TYPERS

Especially qualified to be of service to the school printshop.

Promptness and quality assured.

Forms returned same day received.

Badger - American Electrotype Co.
600 Montgomery Bldg.
407 East Michigan St., Milwaukee, Wis.

1896 — **ORIGINAL Toles Vises** — 1942

18 Models for Woodwork only
2 Actions — 3 Sizes
Write for Prices

W. C. TOLES CO.
Woodstock, Ill.

TOOLS ALWAYS SHARP with PLURALITY OILSTONE TOOL GRINDERS

Now available in 3 sizes
No. 425 Plurality Sub Jr.
No. 450 Plurality Jr.
No. 475 Plurality

No. 450 PluralityJr.

Grinding can be done on a cone, coarse or fine oilstone, leather stropping or emery wheels. Unit is compact, efficient, serviceable, easily accessible and has ball bearing direct motor drive. Especially guarded for school shop use. Details on request.

Mummert-Dixon Co. Hanover, Pa.
Originators and Pioneer Manufacturers of Oilstone Tool Grinders

---

Materials for Brush Making

Brush Fibres, Tampico, Fibre Mixtures, Sterilized Horse Hair. Hair, Bristle and Tampico mixtures solid or taper stock, original lengths cut to size. *Samples matched.*

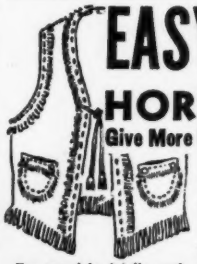
E. B. & A. C. WHITING CO.
Burlington, Vermont

LOOMS, Table and Foot
Reed, Raphia, Handicraft Supplies

Send for catalog

J. L. HAMMETT CO.
CAMBRIDGE, MASS.

EASY "Teacher Saving" HORTONCRAFT
Give More Instruction With Less Work



1. Eliminates Class Preparation drudgery.
2. All leather and parts prepared at factory and shipped in individual packages.
3. Low cost, practical projects.
4. No tools needed for most projects.
5. NO DELAYS — PROMPT DELIVERY.

For complete details send 10c today for Hortoncraft Handbook. Specify grade you teach. Write today.

HORTONCRAFT 622 Capitol Ave. Hartford, Conn.

Archery Materials
Everything for the Shop

The L. C. Whiffen semi-finished lemonwood bows make up into excellent finished bows. School prices are surprisingly low. Send for information or samples. Catalog of complete line also supplied.

L. C. WHIFFEN CO., Inc.
828 W. Clybourn St. — Milwaukee, Wis.

ELECTRIC
MOTOR PARTS
FOR ALL MAKES

ALSO ALL MATERIALS AND TOOLS USED IN THE MOTOR REPAIR SHOP

Free Catalogue to Instructors

READING ELECTRIC CO., Inc.
200 William St., New York

United States Blue Print Paper Co.
A complete line of Drafting Materials for Schools and Colleges
Let us quote your requirements

United States Blue Print Paper Co.
207 South Wabash Ave. — Chicago, Illinois

A New Book in a New Field

Interest Your Shop Classes With Variety and Novelty

A New Book in an Old Craft

AIR CONDITIONING METAL LAYOUT

By JOSEPH J. KABERLEIN

Sheet Metal Apprentice Instructor, Washburne Trade School
Chicago, Illinois

A right-hand man for the teacher or apprentice in air conditioning, heating, ventilating, this is the only book on the market which offers short, modern, practical methods for laying out patterns for square, rectangular, and transition types of fittings in these fields. It clearly shows how the most simple to the most intricate fittings covering almost every kind of piping are laid out in sequence and in a language the apprentice can understand. Useful mathematical formulas and tables are also included.

$3.75

Now . . .

Completely Revised . . .

Thoroughly Up to Date . . .

AUTOMOTIVE ESSENTIALS

By RAY F. KUNS

Providing the most detailed and comprehensive automotive information available today, this Kuns book is designed for the great rank and file of young Americans. Their dependence upon the automobile for transportation demands that they be able to intelligently select, operate, and care for car, and automotive equipment.

This is a beginner's textbook based on fundamentals. Students who master the fundamentals of design of the essential automobile parts can easily apply their knowledge to any and all makes of automobiles. Therefore the over 600 illustrations in this book are those of representative automobile parts and units.

Definite Plan of Instruction

The car is dealt with as a unit, then broken down into minor parts, until each part is illustrated and discussed. Essential parts are disassembled, each step is clearly explained; every design is thoroughly discussed. Or, the process is reversed; the design is discussed as the building up is done step by step. Research questions and problems round out the course and stimulate the student to individual investigation.

$2.32

Send for copies of these books for thirty days' study.

THE BRUCE PUBLISHING COMPANY

501 MONTGOMERY BUILDING MILWAUKEE, WISCONSIN

50 METAL-SPINNING PROJECTS

By JAMES E. REAGAN *and* EARL E. SMITH
Instructors, John Adams High School, Cleveland, Ohio

The authors of the popular METAL SPINNING have filled your need for interesting and easy-to-make projects in this new collection of modern designs, many trimmed with the fascinating and versatile plastic. Each object can be made in the shop with minimum instruction and experience. Besides attractive bowls, lamps, serving dishes, candleholders, ash trays, etc., there is a particularly splendid set of utensils for the camper. Explanations for making are complete, working drawings are detailed, and a photograph of the finished article shows its beauty.

$1.75

Provide a Sound Foundation With These Dependable Texts

METAL SPINNING

By JAMES E. REAGAN *and* EARL E. SMITH
Authors of *50 Metal Spinning Projects*

The fine art of metal spinning is presented in detail so the beginner can master this little known art. Illustrated.

$1.25

METALWORK ESSENTIALS

By F. E. TUSTISON *and* R. F. KRANZUSCH
Instructors, Stout Institute, Menomonie, Wisconsin

Only simple hand tools and a minimum of equipment are required in the processes presented in this book. Divided into 33 units, each involving processes and basic information.

$1.75

MACHINE SHOP PRACTICE

By HARRY A. JONES, *Instructor*
Technical High School, Vancouver, B. C.

The work covered in these two books gives the beginner an understanding of and experience with power tools.

Book I, *$2.00;* Book II, *$2.60*

METAL WORK

By HARRY A. JONES

Intended to be used in the 7th, 8th, or 9th grades, METAL WORK describes the uses and properties, and application in simple projects, of lead, iron, copper, and steel.

$1.24

ELEMENTS OF SHEET METAL WORK

By R. L. WELCH, *State Supervisor,*
Trades and Industry, State Board of Vocational and Adult Education, Madison, Wisconsin

A complete course in elementary sheet-metal work, beginning with simple and basic problems, carrying the student through an understanding of tools and processes to the more complicated trade projects.

$1.32

A COURSE IN SHEET METAL WORK

By J. W. BOLLINGER
Roosevelt Junior High School, Tulsa, Okla.

A beginner's course which gives a thorough understanding of the fundamentals of the trade.

$1.20

ELEMENTARY WROUGHT IRON

By J. W. BOLLINGER

On a junior high school level, this book is ideal for an introductory course in metalworking. It includes 68 projects with simple explanations of iron and steel.

$1.32

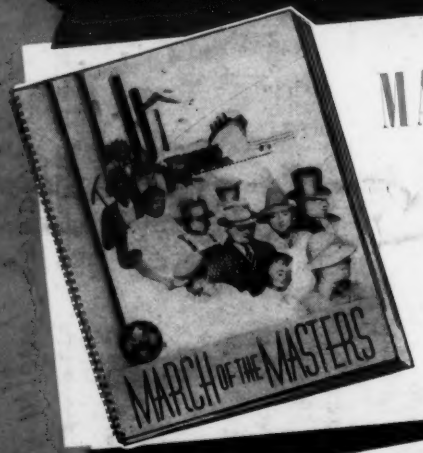
FREE TO INSTRUCTORS

FOUR HELPFUL BOOKS BY LeBLOND

To instructors teaching machine shop practice, we offer free of charge all of the following valuable literature. For your free copy, check the coupon below and mail today.

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lathes



MARCH OF THE MASTERS

An elaborate 52-page book presenting an inspirational story for the student machinist, plus complete specifications on all lathes in the Super Regal line. Special features of design, construction and operation fully explained.

RUNNING A REGAL

A handy handbook welcomed by student machinists everywhere. 112 pages, with over 120 illustrations . . . a comprehensive instruction book, covering all phases of lathe operation and maintenance. (To students 25c per copy).

AMERICA SINGS

Strikingly illustrated with colorful murals . . . depicting in symbolic realism the American scene yesterday, today and tomorrow. The accompanying story is that of the complete line of LeBlond Lathes.

TOOL ROOM GRINDING

Just off the press . . . a complete, 52-page manual of tool room grinding. This up-to-date manual is clear and concise, amply illustrated with large photos, charts, and diagrams. Order your copy today.

For quick specifications on any LeBlond Lathe, see our catalog in Sweet's File.

The R. K. LeBlond Machine Tool Co.
Cincinnati, Ohio

Gentlemen:
Thank you for your kind offer. Please send at once the material checked:

- ☐ March of the Masters . . . . . .
- ☐ Tool Room Grinding Manual . . . . . .
- ☐ Running a Regal . . . . . .
- ☐ America Sings . . . . . .

Name_____

School_____

Address_____

City_____ State_____

LeBLOND
CINCINNATI, OHIO
U.S.A.

. . . . SEND FOR YOUR FREE COPIES TODAY